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Predicting College of Agriculture professors' adoption of computers and distance education technologies for self-education and teaching at the University of Guadalajara, Mexico

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Predicting College of Agriculture professors' adoption of computers and distance education technologies for self-education and teaching at the University of Guadalajara, Mexico

by

Ana Ramirez Carr

A dissertation submitted to the graduate faculty
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This is to certify that the Doctoral dissertation of

Ana Ramirez Carr

has met the dissertation requirements of Iowa State University

Signature was redacted for privacy.

Major Professor

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For the Major Program

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For the Graduate College

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ACKNOWLEDGMENTS

This is a dissertation constructed out of thousands of little fragments. The theoretical and practical interpretations were drawn out of observation and several documents published in Mexico and the United States, and out of endless discussion with Mexican as well as American colleagues, and friends.

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To Ricardo and Adelina *muestros hijos*
who just made me believe more deeply in education.

ABSTRACT

This descriptive and associational study investigated whether personal and institutional characteristics of professors in the College of Agriculture in Guadalajara, Mexico, were related to the use of computers for traditional teaching, and for distance learning and teaching. These characteristics included: interest, attitudes, self-efficacy levels, uses, need for support for faculty development opportunities, and availability of equipment and communications. By using multiple regression and discriminant analysis a series of predictors were identified.

Among the findings it was identified that, in general, professors were highly interested in the use of technology in teaching, and held a positive attitude toward the use of technology for teaching and learning. The professors were already familiar with distance education via satellite, but computer-based education at a distance was not as popular. A need for training was identified in: teaching college courses, taking courses at a distance, and teaching at a distance.

Professors felt confident using electronic mail and the Internet but not in performing more active roles involving the Internet. Also, computers were commonly used for managing instruction, but were seldom used for actual teaching. A significant proportion of the variability in professors' adoption of computer technology in the classroom was explained by four variables: computer self-efficacy, socializing knowledge about computers, frequent use of the Internet, and planning for more use of computers in the classroom.

Five professor characteristics were found to be predictors of potential adoption of distance education for learning. Professors who were not computer self-learners; professors who were in the veterinary discipline, professors who held a bachelor's degree as the

maximum level of education, professors having more years teaching at CUCBA, and professors who would choose distance education via the Internet were more likely to adopt distance education for learning.

Half of the professors were interested in delivering courses at a distance. They were more likely not to be members of a social science discipline, and were not computer self-learners; they more likely socialized knowledge about computers, planned to restructure courses for more use of computers in the classroom, tended to consider distance education an option for learning, and would choose distance education for learning via the Internet, and satellite.

CHAPTER I.
INTRODUCTION

Background and Setting

Since 1995, Iowa State University (ISU) and the University of Guadalajara (U of G) have been developing a collaborative academic relationship. This collaboration has been through the College of Agriculture for ISU, and through the *Centro Universitario de Ciencias Biológicas y Agropecuarias* (CUCBA), or University Center for Biology, Agronomic and Animal Sciences for the U of G. CUCBA is equivalent to a College of Agriculture in the United States. Therefore from this point forward CUCBA will be referred to as the College of Agriculture. The research reported in this document was developed as an outgrowth of this international collaboration.

Both ISU and U of G follow philosophical principles characteristic of the land-grant university system in the United States. The U of G's mission statement embraces teaching, research, and extension as the combination of means to economic development and scientific advancement. A permanent goal is to improve the quality of teaching, research, and extension.

Access to education by all is one premise in the philosophy of public universities. The U of G is the only public university in the state of Jalisco, Mexico. It has about 50,000 students enrolled in higher education, and 96,300 students attending high school (Universidad de Guadalajara [U de G], 1998b). The U of G system of operation is now called *Red Universitaria* or "University Net." The Net is a system that connects several university centers spread throughout the state of Jalisco. In accomplishing the objective of equality of access to education, the issue of access to information represents a major challenge (U de G, 1998c).

Academic level of personnel

Currently the U of G reports having 10,259 academicians. Of these, 120 (1.69%) are from overseas and 53 (0.52%) were educated in other states in Mexico (U de G, 1998a). In addition there is a small proportion of professors that hold graduate degrees. Professors' level of education comes into account when the U of G includes among its weaknesses the statement that the academic culture needs to be reinforced (U de G, 1998c). The current hiring policy is to make attractive offers to people with a doctorate degree, whereas resources and efforts to increase the educational level of current personnel are limited.

Administrators at universities in Mexico pose the questions: What can we do? and What are we doing to improve the level of academia in national educational centers? The National Council for Science and Technology (CONACyT) is one of the institutions that provides scholarships when candidates are nominated by national universities. National universities that have graduate programs represent one option for training, though the variety of subject areas and their capacity are limited. Currently there are several graduate programs in development all over the country. Other options for training are universities in other countries.

The current number of Mexican students sponsored by CONACyT for graduate education in Mexico is 8,500 (Consejo Nacional de Ciencia y Tecnologia [CONACyT], 1998). The number of Mexican graduate students overseas sponsored just by CONACyT is estimated to be 2,500 with 1,250 in the United States (G. Gutierrez-Aguilar, electronic communication, August 31,1998). This number was higher in the past. The constant decline of value of the Mexican peso against the U.S.A. dollar decreases opportunities for the education of Mexican candidates overseas. The United States is not the only country where people go for

education for periods of one to five years; Germany, France, Brazil, and England are also common destinations (CONACyT, 1998). The efforts of CONACyT are important, but still there is the need for more and creative alternatives.

These numbers reveal a need for diversity of ideas, and improvement of the academic level of the personnel. These two aspects could be fostered through the use of telecommunications technology.

Agricultural education issues in Mexico

The concept of agricultural education in Mexico is defined as the scientific study of agriculture as a social, cultural, and economic process (Macías-López, 1990). This concept does not include the specific preparation for teaching agriculture, as it does in the United States. In fact, there are no institutions in Mexico that prepare teachers who will teach agriculture as a career (Robles-Galindo & Suárez-Munguía, 1996).

The *Asociación Mexicana de Educación Agrícola Superior* (AMEAS) (Mexican Association of Higher Agricultural Schools) groups 72 institutions with undergraduate and graduate education in agriculture-related disciplines. The total enrollment was about 20,000 students in 1996 (Asociación Mexicana de Educación Agrícola Superior [AMEAS], 1996). Several authors (Macías-López & Mendez-Cadena, 1995; Robles-Galindo & Suárez-Munguía, 1996; Universidad de Guadalajara [U de G], 1996) consistently point to the need for improving the quality teaching in higher agricultural education. This recommendation was based upon reports that in college teaching there was little use of modern teaching tools, or adequate instructional materials, and that students had little opportunity to be active learners.

However, pedagogical challenges are embedded in the economic and social situation of the country. The generalized economic constraints have kept professors from being able to improve the quality of teaching. Institutions provide limited access to equipment and facilities, and low salaries for professors. These constraints were reported to be the cause of new problems. Professors find themselves in need for diversifying their professional activities in the attempt to improve their income; hence it is common to find professors engaged in professional activities outside the university, affecting academic life as a whole (Robles-Galindo & Suárez-Munguia, 1996).

The College of Agriculture in the University of Guadalajara is not an exception in facing educational challenges in Mexico. To overcome the situation and still encourage development, the U of G has gone through a major structural reorganization that has resulted in what is now called *Red Universitaria* (University Net). The University is now an organizational system that connects several campuses in the state and all the university's activities. This transformation into the University Net required a reform process now called *Reforma Universitaria* (University Reform) which was consolidated legally in 1993. Currently, the University Reform guides most of the activities in the university under the general umbrella of the *Plan Institutional de Desarrollo* 1995-2001 (Institutional Development Plan 1995-2001) (U de G, 1996). This Development Plan is an ambitious program that permeates all areas in the university with the general goal of modernization.

The Development Plan considers eight domains for the modernization process. The development of strategies to strengthen the research program and graduate education emphasizing faculty development opportunities and improvement of computer equipment is

recommended (U de G, 1996). Research programs and graduate education have also received special attention under the North American Free Trade Agreement (NAFTA) since there is now a need to develop homologous processes of international accreditation among Mexico, the U.S.A. and Canada (Macías-López & Mendez-Cadena, 1995; Marquina-Sánchez, 1995).

The University of Guadalajara reports that there are in the U of G about 3,480 professors in higher education (U de G, 1996). With regard to professors' highest educational level, 6% hold a Ph. D. degree, 26% hold the master's degree, 10% have some sort of specialty, and 55% hold the bachelor's degree. With this diagnosis, reformers identified the need to improve the educational level of the academic personnel. There is a specific goal of reducing the proportion of professors with the bachelor's degree to only 30% in the short term. Another goal is to design graduate programs coordinating resources from one or more than one institution either under traditional education, or at a distance, targeting specifically professors. Distance education programs are gaining acceptance, thanks to the progress that national level institutions are making by coordinating efforts such as *Secretaría de Educación Pública* (Ministry of Public Education) and the *Universidad Nacional Autónoma de México* (National Autonomous University of Mexico, UNAM) (U de G, 1996).

With regard to the higher educational level in Latin America, standards for becoming a professor vary. Macías-López (1990) reported that the minimal requirement to teach undergraduate courses varies considerably among the thirty agricultural education institutions in twelve Latin American countries that he surveyed. For some institutions, an undergraduate degree is enough to teach undergraduate courses, and a master's degree is enough to teach at

the master's degree level. He found that the distribution of the highest educational levels among his respondents was 45.3% B.S., 38.3% M.S., and 16.5% Ph. D.

It is interesting to note that the percentages reported by Macías-López (1990) are similar to the ones reported by the College of Agriculture at the University of Guadalajara. With regard to the highest educational level of its academic staff, 46% (193) of professors held a B.S., 38% (160) of professors held the M.S., and 16% (67) of professors, held the Ph. D. (CUCBA, 1997).

When graduate education in agriculture began in Mexico in 1970, it increased significantly the number of opportunities to get degrees beyond the undergraduate level. Before that, the lack of skills in a second language was, in a large number of cases, the biggest impediment for qualified candidates to continue their education. Before 1970, graduate education in agriculture was possible only in other countries, mainly in the U.S.A., Western and Eastern Europe, Asia, and other Latin American countries (Robles-Galindo & Suárez-Munguia, 1996).

From what has been reported above, it is plausible to assume that the situation at the College of Agriculture in Guadalajara is not an isolated case in Mexico. Clearly, there exists a need to improve the academic level of professors, and to foster faculty development in the disciplines and in teaching techniques. Computer technologies may be of assistance in addressing these needs. However, as Young (1993) explains, residents in developing countries need to surmount a diverse array of constraints before being able to use computer technology. Some of these constraints are: (1) the limited resources to acquire equipment, (2) software written in English, (3) lack of computer-literate office workers, programmers and service

technicians, (4) lack of spare parts, (5) low telephone line access, and undependable supplies of electricity. But without computer technology, these nations are even more vulnerable to be marginalized (Young, 1993).

Technology issues

In collaboration with College of Agriculture administrators, the decision was made to conduct the researcher's dissertation study in Guadalajara. Technology issues were suggested from the beginning to be an area in need of research. The researcher first went from Ames, Iowa, to Guadalajara in December, 1996; with follow-up visits during June, 1997; December 1997, and March, 1998. During the initial two trips, interviews were conducted focusing on areas in need of research that meshed with the researcher's areas of expertise. The rest of the trips were to give shape to and conduct the actual study.

During the preliminary interviews two issues were of special interest: (1) access to and use of computer and communications technology; and (2) access to faculty development opportunities. College of Agriculture administrators mentioned that higher administrators at the university believed that there was already more than enough equipment devoted to the college but it was not being properly used. Faculty and staff, on the other hand, did not think this was the case. Faculty members also mentioned the inequality of access to the equipment and the constraints to access to telecommunications. Concerning access to faculty development opportunities, it was evident that faculty were eager to have more opportunities in both formal and non-formal education.

The previous perspective about the use of technology in education is not particular for this audience. There are studies that document that the adoption of computers for university instruction is far from being a reality (Adam & Wilson, 1996; Faseyitan & Hirschbuhl, 1992; Işman, 1997) and that limited technological resources are available for professors in Colleges of Agriculture in Mexico (Robles-Galindo & Suárez-Munguía, 1996).

Social considerations for professors' level of education

Guadalajara is the second largest city in the country with about five million inhabitants. Nevertheless, locally, professors do not have enough options to meet their educational needs. When a professor gets the opportunity of a scholarship and leaves his/her job temporarily to pursue further education, this puts the professor at risk of not being reinstated in his/her previous job. Marital status turns out to be of great importance. For male professors, wives, more often than not, would move with the husband in the event of an opportunity to get another degree. For female professors, the likelihood that the husband would move because of the wife's schooling is very low. When professors return to the university of origin, the re-adaptation process takes time. Before the new degree holders become opinion leaders, they become ostracized under the innovator syndrome (Rogers, 1995).

Institutions have to give up the best and the brightest members for up to five years, in order to allow them to get their degrees and return to their jobs. Some of them do return to their previous job. Some of them find new opportunities in the country where they went for their degree. Some others, if they go back to Mexico, may find better options in the private sector.

Statement of the Problem

Information and communication technologies in developing countries represent new opportunities to achieve educational goals. The diffusion of distance education in Turkey and Venezuela are successful examples (Işman, 1997; Moore & Kearsley, 1996). Experienced educators have found in these technologies ways to cope with both old and new challenges in education (Alvarez-Manilla, 1996). Among the most common challenges are access to the information highway, and training issues.

Distance education has been in practice in Mexico for more than 50 years for a wide variety of purposes, from literacy programs through graduate education, and for formal and non-formal education (Herrero-Ricaño & Barrón-Soto, 1996). However, the availability of new information technologies and its implications in education is a new field that cannot be excluded from the pedagogical agenda (Alvarez-Manilla, 1996). Analysis of opportunities and barriers for technology-mediated delivery of education in Latin American universities is of high interest for local, national and international institutions. The implications include the production of quality programs that are tailored to local needs. In Mexico there is an on-going national effort that focuses on the development of national standards for quality of distance education programs. However in the literature review no studies examining planning issues related to technology use in teaching and distance education were found that were related to professors in higher education.

The U of G is the public university in the state of Jalisco, Mexico, and has the responsibility to make available education to all citizens in the state as a means to foster economic development. The avenues for introducing new ideas in the U of G are limited, and that is why new telecommunication systems have become important. Besides that, at this College of Agriculture, close to half the academic staff hold only bachelor degrees. The conventional mechanisms followed so far by the College of Agriculture to improve the academic level offer little hope for success. This situation calls for an analysis of alternative programs including the use of information technologies that accommodate local circumstances.

In collaboration with the administration of the College of Agriculture, it was decided that research was needed to examine the factors that influence adoption of computers and distance education technologies for teaching and learning. Several questions needed to be answered such as: What are the interests of professors regarding technology-mediated teaching and learning? What are the attitudes they have toward the use of technology in the classroom? What is the extent to which the Internet is being used in teaching? What are the needs from the stand point of professors so that they can incorporate technology in teaching? What are the personal and institutional variables that can help predict professors' adoption of computers and the Internet in teaching? What are the variables that can help predict professors' participation in continuing education and degree seeking programs? What are the variables that can help predict the professors' willingness to teach at a distance? And, what direction should administrators take in organizing faculty development activities?

Purpose and Objectives

The purpose of this study was to determine whether personal and institutional characteristics of professors in the College of Agriculture in Guadalajara were related to the use of computers for traditional teaching and for distance learning and teaching. The objectives of the study were:

1. To identify College of Agriculture professors' interests in the use of computers for traditional and distance teaching.
2. To identify College of Agriculture professors' attitudes toward the use of computers for traditional teaching and for distance learning and teaching.
3. To identify College of Agriculture professors' self-efficacy levels in the use of computers for traditional teaching and for distance learning and teaching.
4. To identify the extent to which College of Agriculture professors currently use computers and electronic communications for teaching.
5. To describe the need for support for faculty development opportunities in subject matter, teaching methods, and degree seeking.
6. To assess faculty perceptions of the technical infrastructure and support systems available to College of Agriculture faculty.
7. To identify predictors of adoption of computers for traditional college teaching and for distance learning and teaching.

Significance of the Problem

This study can be viewed as an assessment of the role of computers in the practice of teaching and learning. This study also provides insight into program planning for future faculty development opportunities in the College of Agriculture. This planning may involve both national and international projects. Just one example of this is the combination of efforts that the National Science Foundation, the Inter-American Institute for Global Change Research, the World Meteorological Organization, and the International Institute of Theoretical and Applied Physics are putting into the translation of an Iowa State University-based Global Change course into Spanish and Portuguese (Gene Takle, electronic communication, September 30, 1998). Their intent is to deliver this course to fifteen Latin American countries. Since most of the universities included in this project are public universities with characteristics similar to those of the University of Guadalajara, it is likely that professors need graduate degrees. Professors are then potential students of this course. The product of this study provides timely information required in the decision making process for this kind of project. This study may also help predict enrollment, and contribute to decision making for advertisement and recruitment efforts.

Limitations

This study has the following limitations.

- The applicability of this research is limited to one specific college at one specific university, the College of Agriculture (CUCBA) at the University of Guadalajara.
- Since this study is exploratory in its nature, it is limited by the fact that the researcher

may have not included all appropriate variables for predicting the dependent variables.

- The questionnaire used to collect data from the population was designed specifically for this study. Improvements to this questionnaire should be made prior to using it again. A more valid and reliable questionnaire might result in better prediction of the adoption of computers for traditional college teaching and for distance learning and teaching.

Definition of Terms

- Adopters are those professors who currently use computers and electronic communication in college teaching.
- Attitude is a relatively enduring organization of an individual's beliefs about an object that predisposes his or her actions (Rogers, 1995).
- Computer and the Internet use in education refers to the incorporation of electronic technology into teaching activities. The electronic technologies can be used minimally or intensely in the same course.
- Computer use is the use of one or more computer applications regardless of whether the use is incorporated in teaching.
- Continuing education is any organized learning activity for adults designed to update, maintain, or expand knowledge or skills through such vehicles as short courses, workshops, symposia, and conferences (Scanlan & Darkenwald, 1984).
- Degree seeking refers to any organized learning activity that students join to accumulate credits towards a degree.
- Distance education is "planned learning that normally occurs in a different place from

teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements" (Moore & Kearsley, 1996, p.2).

- Interest is a feeling of concern or curiosity about something (Webster, 1966).
- Internet use is the use of the global computer network which may include use of the World Wide Web, regardless of whether or not the use is incorporated into teaching.
- Need for support in this study refers to professors' manifest statements of their desire for more access to equipment, communications, or training opportunities.
- Perceptions of infrastructure available is the individual's judgment of the availability of equipment based on personal experience and opinion. This judgment may not be based on a systematic assessment.
- Pedagogy the art or science of teaching; especially, instruction in teaching methods.
- Potential adopters of distance education for learning are those professors who more likely will use distance education for self-education.
- Potential adopters of distance education for teaching are those professors that more likely will teach at a distance.
- Self-efficacy is an individual's judgment of his or her capabilities to organize and execute courses of action required to attain designated types of performances. Self-efficacy mediates the relationship between knowledge and action (Bandura, 1986).
- Traditional teaching is the educational encounter that implies the physical presence of both learner and facilitator, in the same location at the same time, regardless of the teaching equipment and materials utilized during that encounter.

CHAPTER II.
LITERATURE REVIEW

The integration of technology in education is a contemporary topic. Proponents and skeptics debate this integration, seeking to clear away confusions that dominate and distort the discussion (Cwiklik, 1997). In this literature review focus is placed on factors related to the adoption of technology for academic activities in higher education. These factors are related to interests, attitudes, educational needs, current uses and potential adoption of technology for teaching and learning, as they relate to professors in the College of Agriculture in Mexico.

The chapter contains three sections that include electronic technology in education, distance education, and the theoretical framework. The first section of this chapter refers to electronic technology in education. This section includes the role of technology in the classroom and attitudes and training issues related to the integration of technology and traditional teaching. The second section refers to distance education. Here, a perspective of the practice of distance education in Mexico is provided, followed by general issues in distance education such as market research, credibility, and training needs. The third section constitutes the theoretical framework that includes the concepts of adult education, self-efficacy, diffusion of innovations, and needs assessment.

This chapter concludes with a conceptual framework for three proposed models to explain professors' (1) adoption of computers and the use of the Internet in classroom instruction, (2) potential adoption of distance education for learning, and (3) potential adoption of teaching at a distance.

Electronic Technology in Education

The use of electronic technologies in the classroom has a great potential to contribute to the improvement of instructional programs (Liao, 1998; McCaslin & Torres, 1992; Papert, 1995; The Wall Street Journal, 1997). Electronic technology can be used in the form of computer-supported teaching and learning applications classified as experiencing, informing, reinforcing, integrating, and utilizing (Thomas & Boysen, 1984). Other forms of electronic technology for the classroom are the use of slide presentations and the Internet. Further forms include the use of electronic devices for delivering class materials or consultations using the Internet, fax, or telephone.

Research (Day, Raven & Newman, 1996; Goldberg, 1997; Liao, 1998; Nooriafshar, 1998) and teaching experiences (Harris, 1992; Schumacher & Strickland, 1992) show that the incorporation of multimedia instruction in the classroom enhances students' understanding and achievement levels, improves students' attitudes toward learning, helps students sustain interest in the materials, and does not harm their attitudes toward computers, the Internet, and learning. In a meta-analysis of 35 studies, it was found that the effects of using hypermedia in instruction are positive when compared to conventional instructional methods (Liao, 1998). The adoption of these tools in education was recommended by Nordheim & Connors (1997) since its incorporation can help students gain valuable skills needed for a career.

Notwithstanding the existence of consistent research providing evidence of the benefits of integrating computers in the classroom, this integration has not reached its full instructional potential (Thomas & Boysen, 1984). Osborne (1992) stated that agricultural educators mostly

use computers for *managing* instruction rather than for *teaching* with computers. Birkenholz (1992) reported that even when 73% of all agriculture programs in the U.S.A. have access to computers, this does not lead automatically to their use in teaching. The computer has been used "as a teaching device rather than a learning device." (Thomas & Boysen, 1984, p.15). Thomas & Boysen (1984) suggested that computers provide a medium through which the student can learn in a self-education process. Their statement is still applicable fourteen years later, and may be an explanation of the attitudes held by some instructors that prevents adoption. Educational programs that include computer-mediated learning require training of instructors (Birkenholz, 1992). Otherwise, experiences may result in strengthening an already-negative attitude toward computers, as was the case reported by Nehiley (1998).

The search for identifying the variables that influence educators' adoption of electronic technology in the classroom has been a common concern in research (Beal, 1981; Birkenholz, 1992; Faseyitan & Hirschbuhl, 1992; Faseyitan, Libii & Hirschbuhl, 1996; Masiclat, 1992; Wu, 1996; Yarbrough, 1986). There has also been a concern to find the main uses of the computer in the classroom (Adam & Wilson, 1996; Nordheim & Connors, 1997).

In a study conducted among Australian higher education instructors (Adam & Wilson, 1996) it was found that educators adopted information technology for their own professional activities earlier than the broader community. However, educators were not ready to use these technologies in the future in their teaching. Yet, the authors confirmed the existence of a "bandwagon effect." This effect is better known as *critical mass* (Rogers, 1995). Critical mass is particularly relevant to interactive innovations and occurs when enough individuals have adopted an innovation so that further adoption becomes self-sustaining.

Beal (1981) explained that administrators demonstrated a lack of concern for faculty levels of readiness for adoption of instructional television in the classroom. He reported that attitudes faculty held toward technology in the classroom were not isolated, but instead were often interconnected with attitudes toward other teaching technologies. Beal stated that the strategies for rewarding professors were not well designed. Reward systems too frequently emphasized tangible rewards, overlooking the importance of self-motivation. Garton & Chung's (1996) findings supported Beal's statement. Inadequate reward systems and lack of concern shown by administrators were evident in their study of in-service needs rated by beginning agriculture teachers in the state of Missouri, in comparison with members of the Joint State Staff in Agricultural Education. State supervisors and teacher educators ranked the skill "Using computers in classroom teaching" as number 40 in a list of 50 professional competencies, while beginning teachers placed this in-service need as number 9.

Instructors' beliefs that they need instruction and more experience to teach with computers has been found by several authors (Birkenholz, 1992; Bulkeley, 1997; Nordheim & Connors, 1997). Nordheim and Connors (1997) analyzed the actual uses of computers in the classroom, once availability was provided. Their study population included agricultural education instructors in the Northwest U.S.A. They found that word processors were the most widely used computer software, followed by graphics presentation programs and spreadsheets. Instructors were found to agree that using computers in their instructional program was very beneficial for them and their students. But they also felt that they had limited experience with using computers as instructional tools. These findings were consistent with other reports that instructors felt ill-prepared to use computers in the classroom

(Bulkeley, 1997). In fact most educators were unprepared to use computers as a teaching tool. It was estimated that nearly half the teachers in the United Stated had little computer training or experience, and only 13% of school systems mandated computer training. Even those teachers who had experience "have never been taught how to teach with them." (Bulkeley, 1997, p. R4).

Another study (Faseyitan & Hirschbuhl, 1992) focused on the effects of personal factors on college professors' adoption of computers in the classroom. They found significant differences between adopters and non-adopters. Adopters had a positive attitude toward computers, their disciplines were more technology-oriented, and they generally had computer skills. Similar findings regarding technical orientation and computer adoption among Cornell University faculty were reported by Yarbrough (1986), Masiclat (1992), and Wu (1996). Therefore they tended to use the computers for instructional activities. Gender, rank, research commitment, instructional policy, technical support, and staff development did not significantly affect adoption rates. Faseyitan and Hirschbuhl (1992) recommended that a good strategy to enhance adoption rates would be directing resources toward intrinsically-oriented incentive schemes, and training to increase self-efficacy levels. Faseyitan, Libii and Hirschbuhl (1996) applied the previous recommendations in the design of an in-service program. The focus of the program was to enhance faculty computer self-efficacy as a way to support professors in the use of computer technology in instruction. Showcases and demonstrations programs, seminars, and workshops were components of the program. The authors reported a gain in faculty confidence and self-efficacy.

Distance Education

Electronic technologies are contributing to the diffusion of distance education programs in developing countries, providing opportunities that were not available under the traditional system (Rumble, 1986). At the higher education level, India, Pakistan, Turkey, and Venezuela, are repeatedly cited as successful examples (Brown & Brown, 1994; Işman, 1997; Moore & Kearsley, 1996; Rumble, 1986). Experienced educators in Mexico are finding that the advantages of modern technologies help them to cope with both old and new challenges at the higher education level (Alvarez-Manilla, 1996).

Distance education techniques have been successfully used by non-conventional audiences all over Mexico since 1947 when the literacy program started (Herrero-Ricaño & Barrón-Soto, 1996). Another successful example is *telesecundaria* (middle school via microwave network television), established in 1966 to provide alternative secondary education, particularly in rural areas, where students are taught by televised lectures supported by workbooks (Rumble, 1986). At the higher education level, the National University (UNAM) started the Open Education System by 1972 (Herrero-Ricaño & Barrón-Soto, 1996), and by 1980, the *Universidad Pedagógica Nacional* (National Pedagogy University) was providing in-service training and graduate education to elementary school teachers nationwide with 3,000 conventional students in Mexico City and 60,000 distance ones (Rumble, 1986).

Previous experience and new programs suggest that there is potential for development of distance education programs based on electronic technology. Currently, there exists a

national effort that the Ministry of Public Education (SEP) and the National University (UNAM) developed jointly. Fifty-one institutions from all over the country participate in this effort (Herrero-Ricaño & Barrón-Soto, 1996). With regard to training and administration, Alvarez-Manilla (1996) reported on the programs that the National University is targeting in its distance education project. The aspects related to training and pedagogical issues, and development and production of learning materials, are handled via the Center for Research and Educational Services. University of Guadalajara administrators are considering encouraging faculty to enroll in this Center, as a potential method of getting degrees beyond the bachelors level, and thus moving from the 50% down to 30% as maximum percentage of professors with bachelors degree only (U de G, 1996).

With regard to infrastructure, public and private educational institutions have used television and interactive videoconferencing through compressed video during the last five years (Alvarez-Manilla, 1996), and more recently via the Internet. The National Distance Education Program operates through *Red Edusat* (Edusat Net), *Red Escolar* (Scholar Net), and a videoconference linkage. The Scholar Net is a network that will provide Internet access to up to 140,000 elementary- and middle-school computer labs over the next five years (Pisanty, 1998; Wired News, 1998). Pisanty (1998) reported that of the television, the Internet and the interactive videoconferencing programs that started by 1994, the most active unit is the one delivered via the Internet by the Online University Program.

In a cost analysis of the structure of television, videoconferencing and Internet use, Pisanty (1998) reported that for Internet use in Mexico, the cost structure is gradually approaching that of the United States. The cost of on-line courses is lower than

videoconferencing systems, and even on-line components are becoming part of videoconferencing. However, he suggested that in the Mexican culture, people would be more in favor of videoconferencing –since it provides the person-to-person interaction– and less in favor of either written communication, or person-to-learning-material approaches, such as on-line courses. That is why (according to Pisanty) videoconferencing has a better chance of success, in spite of its cost, although he suggested the need for quantitative research in this area.

All this administrative and technological infrastructure could portray a scenario that provides access to education to a broader community. However, when it comes to an individual's access to the Internet, one factor to consider is the unevenness of telephone coverage in the country. Mexico has on average 11 telephone lines per 100 inhabitants, and actual coverage ranges from 22 in Mexico City to four in Chiapas. This explains, in part, the small number of Internet users in Mexico, estimated to be 400,000 (Pisanty, 1998).

Internationalism in the practice of distance education is a popular topic. Bowen & Thompson (1995a) suggested that distance education via satellite provides opportunities at the international level for agricultural educators in the U.S.A. They found that administrators in agricultural sciences reported wanting to deliver more instruction via satellite, and they perceived that technological infrastructure is readily available. Moore and Kearsley (1996) reported that some American institutions have experimented with teaching in other countries by teleconference. Among those mentioned that have had experiences in Mexico are Pacific Presbyterian Medical Center of San Francisco, Ramapo College of New Jersey, and Pennsylvania State University. The authors reported on a plan to establish a North American University and mentioned that Mexico's economic struggles have been a factor that slowed

the development of a trilateral North American Distance Education Research planning team among Canada, Mexico and the U.S.A.

Moore and Kearsley (1996) utilized the theory of *transactional distance* to explain distance as a pedagogical phenomenon. This theory emphasizes the effect that distance has on the system to accomplish and overcome pedagogical issues, not geographic issues. The communications gap and potential misunderstandings that may arise with geographical distance is what constitutes the transactional distance. Misunderstandings can occur with any educational encounter, but in distance education the separation of facilitator and learner is so significant that it affects their behaviors.

Distance education courses still struggle to gain respect in the broader society. Credibility is an issue since there exists the general idea that distance education courses lack academic rigor or effectiveness; hence they are not universally well recognized, particularly in the job market. Graduates from distance education programs typically have less chance than traditional university students of finding good jobs (Işman, 1997). Miller and Shih (1997) found that, indeed, Iowa State University faculty perceived off-campus courses (using distance education technologies) to be less rigorous than on-campus courses.

The topic of effectiveness is perhaps the area with the most research in distance education (Moore & Kearsley, 1996). Threklekd and Brzoska (1994) mentioned that there are several media use comparison studies in education that are extensive reviews of the field of media comparison. One of the better known reports in this area is found on Russell's (1997) web site, http://tenb.nbcc.nb.ca/phenom/. On this site, Russell describes the *No Significant Difference Phenomenon*. Russell put together 248 research reports, written between 1928

and 1996 that concluded there is no significant difference in student achievement, attitudes, and retention when they are compared by the way the educational projects were delivery.

With regard to training, Bowen and Thompson (1995b) studied agricultural sciences department heads' perceptions of the need for distance education. They found that of 277 respondents in 42 different (mostly) land grant institutions in the U.S.A., 70% of them believed that faculty needed training in delivering courses at a distance. This was consistent with Murphy and Terry's (1995a) findings and recommendations. They found that faculty perceived themselves as having limited competence in the use of electronic technology and teaching methodologies to deliver courses at a distance. Faculty also perceived themselves to have limited access to training, technical assistance, equipment, and facilities. They established a need for the development of training programs to help professors become proficient in delivering courses at a distance.

In the area of instructional design, Miller and Carr (1997) conducted a study to identify the information and training needs of agricultural professors related to distance education. Professors were asked to rank 22 topics related to distance education. They found that for faculty in 1862 land-grant universities, the top five highest rated topics were (1) teaching techniques for distance education, (2) enhancing interaction in distance education, (3) learner centered teaching techniques, (4) designing instruction for credit courses, and (5) models of effective distance teaching. However, in practice, it was found that individuals with previous experience in delivering presentations but no previous experience in delivering at a distance were, with the help of site facilitators, also capable of reaching an effective level of proficiency when using interactive video equipment (Kennedy & Agnew, 1998).

Theoretical Framework

Adult education

Considering adults as learners implies specific learner characteristics. These characteristics of learners are (1) their special orientation to learning, (2) their experiential base, (3) their particular developmental changes and tasks, and (4) their anxiety regarding learning (Brookfield, 1986).

Adult education is sometimes referred to as *andragogy*. Knowles (1970) is considered to be the author who coined the term. However, Brookfield (1986) reports that this term was already being used in Germany by 1927. In 1970 Knowles presented a set of four assumptions as a model of adult learners. Knowles stated that as people mature, their self-concept moves from one of dependency to independency, or self-directedness, and they accumulate a reservoir of experiences on which they build their learning. Also, as people mature, their readiness to learn becomes increasingly associated with the development of social roles, and their time and curricular perspectives change from postponed to immediacy of application and from subject centeredness to problem centeredness.

Some authors warn of the dangers of using Knowles's assumptions literally (Boulton-Lewis, Wilss & Mutch, 1996; Brookfield, 1986). It is adventurous to assume that adults know what they need to learn and what their problems around learning are, and the assumptions seem to be based on conventional wisdom rather than on empirical research (Boulton-Lewis et al., 1996). In the area of needs for learning, Brookfield (1986) mentioned that "There are good grounds, . . . , for maintaining that self-directedness –that is,

autonomous control over aspects of work life, personal relationships, societal structures, and educational pursuits– is an empirical rarity" (p. 94). This indicates that it would be better to consider enhancement of self-directedness as the proper purpose of adult education. Fosnot (1992) emphasized that students' responsibility for their own learning, their experience upon which they learn, their readiness to learn, and internally motivated learning, are assumptions of the constructivistic learning and teaching process. Fosnot does not specify age groups in this process.

Adult education can be better defined as a transactional process where the facilitator helps adult learners to identify their needs and analyze their problems, based on the learners' situation, including their psychological, social and economic circumstances (Galbraith, 1991). The characteristic of being able to identify their needs and problems, would be better regarded as a desired outcome of a transactional process. When planning instruction, needs assessment is a starting and ongoing process. Galbraith stated that a more rational approach to defining learner needs and desired outcomes is to conduct needs assessments. An assessment would include a combination of felt needs (related to learner desires) and prescribed needs (related to what the facilitator feels adults should acquire). The scaffolding idea, or the coaching role of the teacher, used by constructivist authors to describe learning, is the process in which the learner builds a personal interpretation of experience by the giving up of previous paradigms. As Fosnot (1992) states: "...the development of the idea, the progressive ordering and reordering, is of prime importance -and indeed is the essence of constructivism." (p. 169). This idea explains those situations where students almost hate the professor in the transition of

giving up the previous paradigm and feel the *epistemological nostalgia* mentioned by Robertson (1996), until the student develops a new idea.

With regard to Galbraith's (1991) cited definition of adult education where the need is defined from the standpoint of the students' psychological, social and economic circumstances, it is important to consider Scanlan and Darkenwald's findings (1984). They found that socio-demographic variables explained only 10% of the variance associated with participation in continuing education programs. The same was true for motivational orientation factors. They found that 41% of the variance in participation status among health professionals was explained by the combination of six factors. The factors included disengagement, lack of quality, family constraints, cost, lack of benefit, and work constraints. Jordan (1995) did a study of participation in continuing education via electronic communication among Iowa Soybean Association members. He found that both cost and lack of time for class were barriers to participation. Communication apprehension and computer anxiety did not constitute major obstacles, nor did the fact that they were being watched by a video camera.

Self-efficacy

Bandura (1986) defined perceived self-efficacy as people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. This concept is also known as *efficacy expectancy* (Kinzie, Delcourt & Powers, 1994). According to Bandura, success requires effort and perseverance, so that performance

operates partially independently of underlying skills. This is why self-efficacy is concerned not with the skills one has but with judgments about performance.

Bandura further explained that self-knowledge about one's efficacy, whether accurate or faulty, is based on four principal sources of information: (1) authentic mastery experiences; (2) observing the performance of others; (3) verbal persuasion and allied types of social influences which indicate that one possesses certain capabilities; and (4) physiological states from which people partly judge their capability, strength, and vulnerability to dysfunction.

Attitudes toward computers have been found to be significant contributors to prediction of self-efficacy for computer technologies (Kinzie, Delcourt & Powers, 1994; Zhang & Espinoza, 1998), while computer self-efficacy has been found to be significantly related to computer-dependent course performance (Karsten & Roth, 1998). Furthermore, self-efficacy was found to be related to goal level as a contributor to the motivational process that explains and predicts individual performance (Phillips & Gully, 1997). Phillips and Gully reported that what causes people to set higher goals is not the measured ability (an objective concept of ability), but rather self-efficacy (a subjective concept of ability), which has a higher correlation. They use a proposed integrated model of individual differences, goal-setting and self-efficacy theories represented in Figure 2.1. In this model *learning goal orientation* (the belief that abilities are malleable) correlates positively with self efficacy, whereas *performance goal orientation* (the belief that capacities are fixed and tasks are performed with the intention to perform well) correlates negatively with self-efficacy. *Locus of control* is a personality attribute reflecting the degree to which one generally perceives events to be under one's

control (internal locus) or under the control of powerful others (external locus). The numbers on the arrows (Figure 2.1) indicate the standardized path coefficients where *p<.05 and **p< .01.

Diffusion of innovations theory

In this chapter it has already been documented that the incorporation of computer technology in teaching brings advantages. Why, then, are there differences in time of adoption, and in uses of the technology among individuals in a social system? Rogers (1995) stated that getting a new idea adopted, even when it has obvious advantages, is not an easy task.

Rogers defined diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. In every diffusion

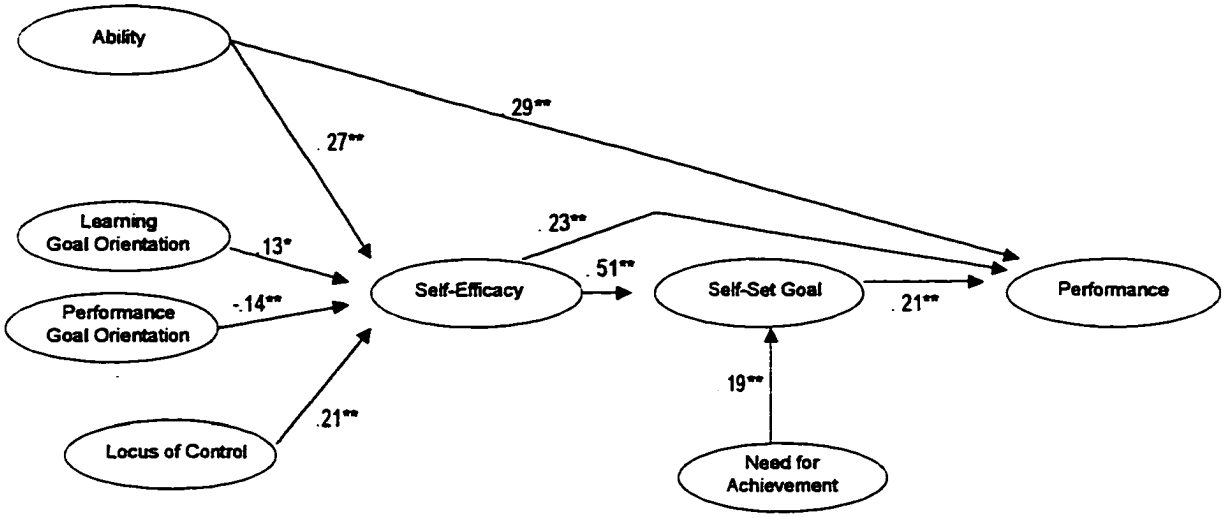

Figure 2.1 From Phillips and Gully's (1997) integrated model of individual differences, goal-setting, and self-efficacy theories with standardized path coefficients with *p<.05 and **p< .01.

process the *innovation*, the *communication channels*, the *time frame*, and the *social system* are identified. The innovation is an idea, practice or object that is perceived as new by the unit of analysis. The time dimension is involved in diffusion (1) in the innovation-decision process by which an individual passes from first knowledge of the innovation through its adoption or rejection, (2) in the innovativeness of an individual compared with other members of a system, and (3) in the rate of adoption in the system, measured as the number of members of the system that adopt the innovation in a given time period. In the innovation-decision process, at the persuasion stage, the main outcome is the individual's favorable or unfavorable attitude toward the innovation.

The computer is an innovation that meets all five attributes that influence the rates of adoption as discussed by Rogers. These attributes imply that computers and electronic communications (1) offer a *relative advantage* by being considered better than the previous options, (2) are *compatible* with the existing values system, (3) and are *complex* in hardware and software. Also as attributes of innovations, computers (4) have already been available, so professors have experimented in order to consider adoption (*trialability*), and (5) professors have been able to observe other professors using computers (*observability*).

The category of *adopter* is the classification of members of a social system on the basis of *innovativeness* (Rogers, 1995), and represents the degree to which an individual is relatively earlier in adopting new ideas than others. Adopters are placed in five categories: innovators, early adopters, early majority, late majority and laggardss. *Innovators* are considered to be venturesome and more cosmopolitan, and they socialize with other innovators. They also possess more financial resources, but they may not be respected by the

other members of a local system. They normally are not opinion leaders. *Early adopters* are more integrated into the local social system and have the greatest degree of opinion leadership. The *early majority* adopts new ideas just before the average member of a system. The *late majority* adopts new ideas just after the average member. *Laggards* are the last in a social system to adopt an innovation and possess almost no opinion leadership.

Needs assessment

Authors (Albrecht, & Bardsle, 1994; Rumble, 1986) suggested that we should be cautious when embarking on distance education programs. Not all educational needs or learning goals may be satisfied with distance education. That is why it is recommended that a needs assessment study be conducted. In distance education, Eastmond (1994) recommended using the definition of *need* as the gap between "what is" and "what should be" regarding the learners' level. This is part of the market research which helps to identify potential demands. Albrecht and Bardsle (1994) suggested the use of strategic planning when considering distance education. In this process, data gathering and analysis are only the first sections of a broader plan. This should provide some guidance and avoid premature selection of technology, technical planning, and neglect of market factors. In this planning, internal factors are included where authors recommend being conscious of the culture of the institution. It also is recommended that a resource availability assessment be performed.

Summers (1987) stated that needs assessment is far more than a matter of choosing techniques for gathering information about people's preferences. This is a scientific tool to help groups express their real concerns more accurately, and to participate in decision making.

Needs assessment serves as the means by which community integration, self-help, and empowerment are achieved. Needs assessments are conducted with the purpose of producing information that becomes the supporting evidence needed to pursue a goal. This information clearly implies that a needs assessment is conducted with a political aim, policy or program purpose in mind. Evidence is provided with the intent of proving a case, and not all information is perceived as evidence by decision-makers (Hobbs, 1987).

Caffarella (1982) described assessment as a systematic way of identifying educational deficiencies or problems. She focused on identifying the major educational problem areas, and making sure that individual (motivational) and organizational (prescriptive) needs are addressed. This process involves: (1) planning, (2) doing the needs assessment, (3) priority setting and (4) action planning. Another way to see this process was presented by Hobbs (1987). He proposed a full scale strategy for needs assessment where the features are: Who is the needs assessment intended to inform/influence? What purpose is intended? Whose needs are to be assessed? What questions are asked? and What resources are available?

"Until the need has been adequately identified, an appropriate solution is unlikely to be found. Once the need has been specified, an amazing number of potential solutions become possible." (Eastmond, 1994, p. 91).

Summary

The body of literature in this chapter addressed the research questions and objectives of this study regarding the role of electronic technology in education, distance education issues, concepts of adult education, computer self-efficacy, diffusion of innovations, and needs

assessment. It was identified in the literature that interest, attitudes, computer self efficacy, professional development opportunities and perceived availability of technical infrastructure and support systems, all are factors influencing professors' adoption of computer technology in classroom teaching, and the potential adoption of distance education for teaching and for learning. This review also helped the researcher to select variables to meet the objective of identifying predictors of adoption. Three exploratory models were developed to begin the inquiry in determining what professors' characteristics influence the outcome in the dependent variable in each model. Variables were also selected based upon personal experiences of the researcher, and suggestions of education professionals and other colleagues.

Conceptual framework

In Model 1, the dependent variable was "professors' adoption of computers and the Internet for classroom instruction" where twenty-nine variables were considered. In Model 2, the dependent variable was "professors' potential adoption of distance education for learning." Since the medium of interest for the use of distance education opportunities was the Internet, all variables that were included in Model 1, related to the use of computers, were considered in Model 2. Also were included in Model 2 those variables related to training needs, perceptions of distance education, and the use of alternative mechanisms to deliver education. In total thirty-six variables were considered in this model.

In Model 3, the dependent variable was "professors' potential adoption of teaching at a distance." Since the medium of interest for the delivering courses at a distance was the Internet, all variables that were included in Model 1, related to the use of computers, were

considered in Model 3. Also, all variables related to training needs, perceptions of distance education, and the use of alternative mechanisms to deliver education, from Model 2, were included. Additionally, it was considered that professors' interest in delivering courses at a distance would be influenced by their willingness to receive training at a distance. Thirty-seven variables were considered in this model.

Model 1 (Figure 2.2) presents the variable "Professors' adoption of computers and the Internet for classroom instruction," as potentially influenced by twenty-nine characteristics of professors presented in five groups. (1) *Demographic* characteristics included age, levels of education, years teaching, and subject matter discipline. (2) *Other uses of computers* included characteristics such as whether they used more than one computer application, whether they used more than one Internet application, having access to a computer at home, having an Internet account, and using it. (3) The only *institutional factor* that was included was related to access to computers in the work environment. (4) *Training* characteristics included whether they had recent formal training, and whether professors were computer self-directed learners –or required instruction as a condition of using computers. (5) *Attitudes toward computer and Internet use* included professors' interest in computer learning, whether they wanted to improve software skills, having the opportunity to socialized knowledge and troubleshooting computer problems, whether they were planning to restructure courses to incorporate more use of computers in the classroom, professors' computer self-efficacy scores, and whether they wished to have more access to computers, technical support, World Wide Web, e-mail, software, and manuals.

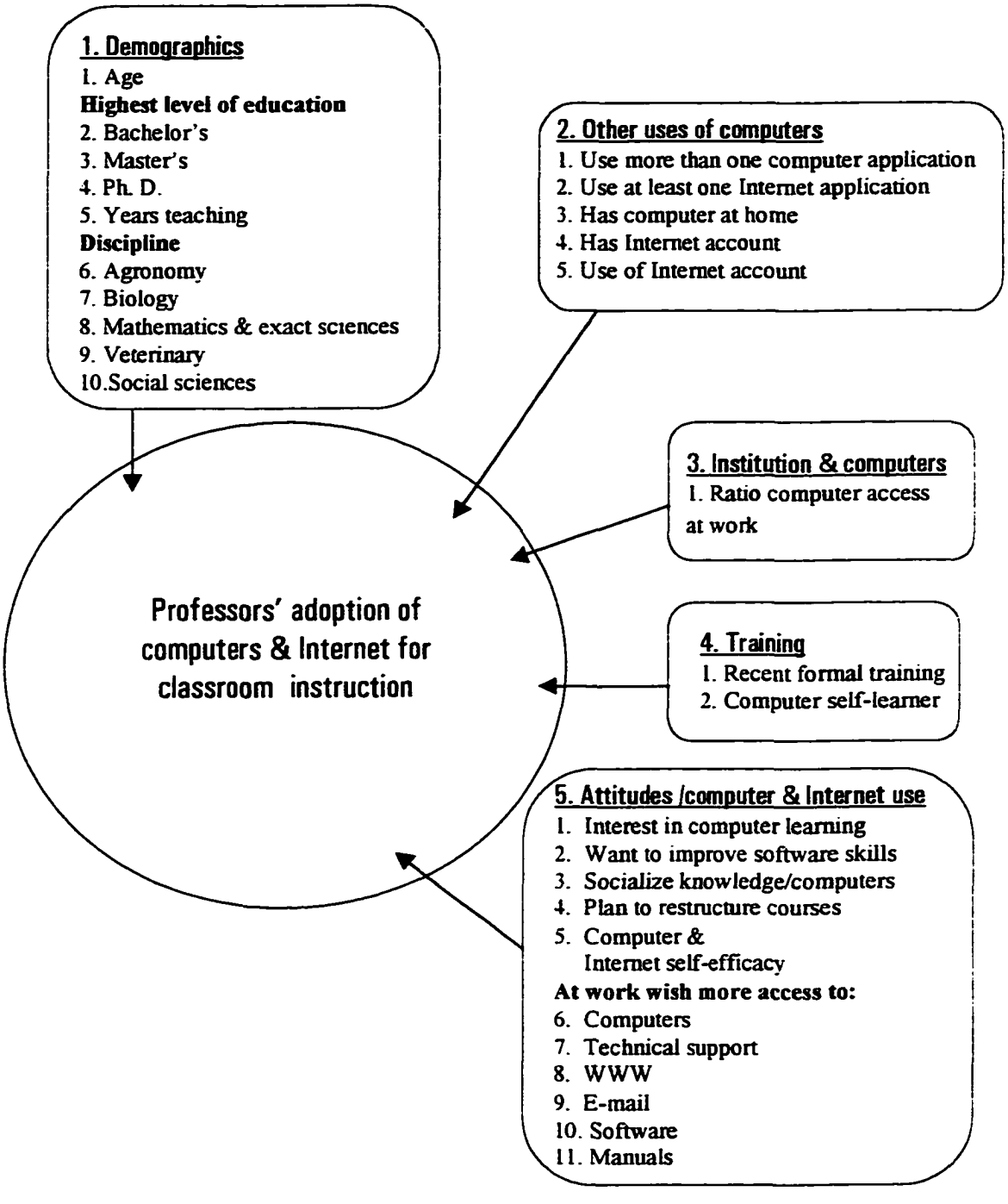

Figure 2.2 Model 1. Conceptual framework with factors related to professors' adoption of computers and the Internet for classroom instruction.

Model 2 (Figure 2.3) presents the variable "Professors' potential adoption of distance education for learning," as potentially influenced by thirty-six characteristics of professors presented in five groups. (1) *Demographic* characteristics included age, levels of education, years teaching, and subject matter discipline. (2) *Uses of computers* included characteristics such as whether they used more than one computer application, whether they used more than one Internet application, having access to a computer at home, having an Internet account, and using it; and their use of computers and the Internet in the classroom. (3) The only *institutional factor* that was included was related to access to computers in the work environment. (4) *Training* characteristics included whether they had recent formal training, whether professors were computer self-directed learners or they required instruction as a condition to use computers, whether they were interested in continuing professional education, and whether they believed they needed another academic degree. (5) *Attitudes toward computer and Internet use* included professors' interest in computer learning, whether they wanted to improve software skills, having the opportunity to socialized knowledge and troubleshooting about computers, whether they were planning to restructure courses to incorporate more the use of computers in the classroom, professors' computer self-efficacy scores, and whether they wished to have more access to computers, technical support, World Wide Web, e-mail, software, and manuals in the work environment. (6) *Distance education learning* included whether professors had used alternative media to learn, and which media they would be willing to use in taking distance education courses: Internet, satellite or video.

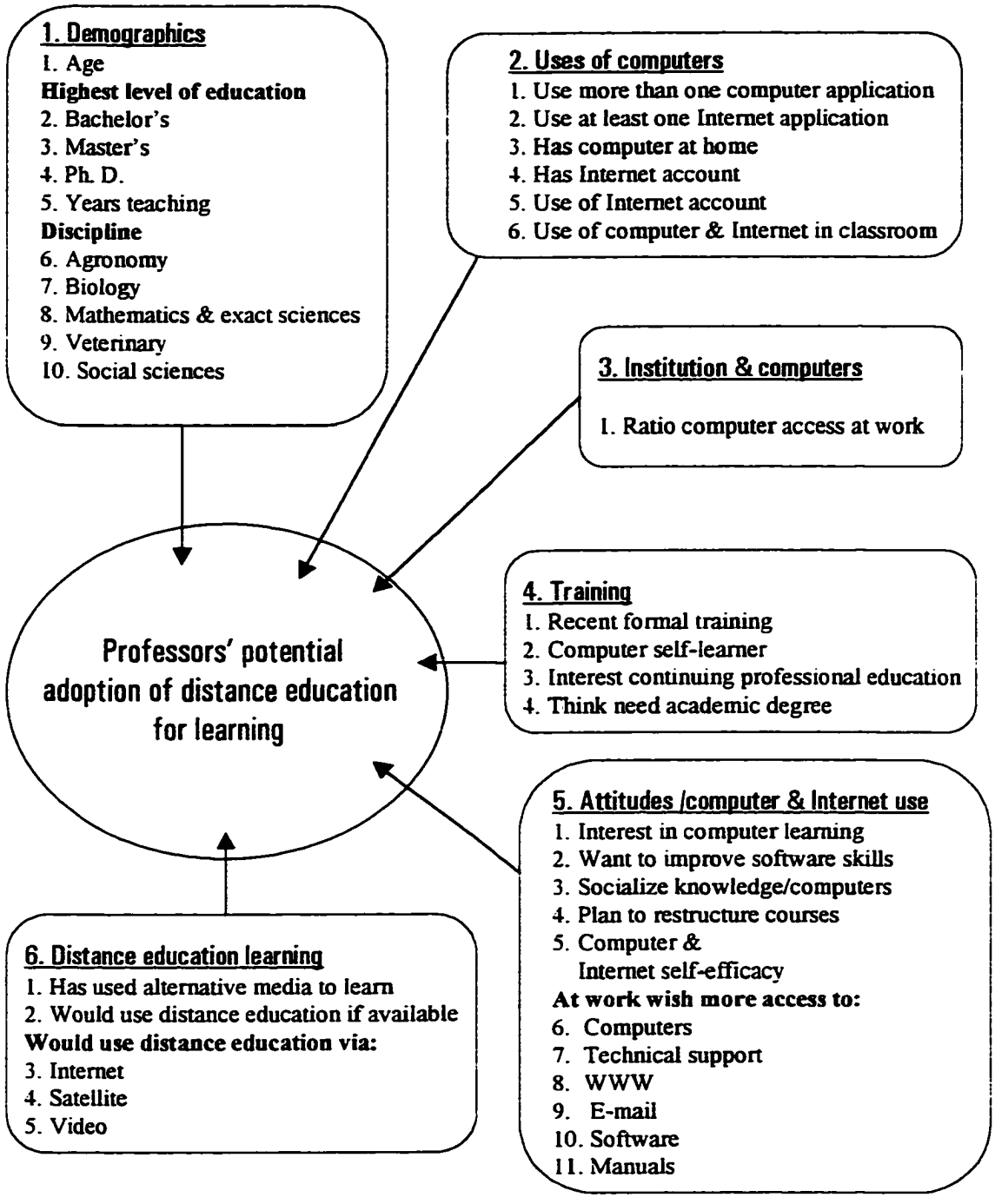

Figure 2.3 Model 2. Conceptual framework with factors related to professors' potential adoption of distance education for learning.

Model 3 (Figure 2.4) presents the variable "Professors' potential adoption of distance education for teaching," as potentially influenced by thirty-seven characteristics of professors presented in five groups. (1) *Demographic* characteristics included age, levels of education, years teaching, and subject matter discipline. (2) *Uses of computers* included characteristics such as whether they used more than one computer application, whether they used more than one Internet application, having access to a computer at home, having an Internet account, and using it, and their use of computers and the Internet in the classroom. (3) The only *institutional factor* that was included was related to access to computers in the work environment. (4) *Training* characteristics included whether they had recent formal training, whether professors were computer self-directed learners or they required instruction as a condition to use computers, whether they were interested in continuing professional education, and whether they believe they needed another academic degree. (5) *Attitudes toward computer and Internet use* included professors' interest in computer learning, whether they wanted to improve software skills, having the opportunity to socialized knowledge and troubleshooting computer problems, whether they were planning to restructure courses to incorporate more the use of computers in the classroom, professors' computer self-efficacy scores, and whether they wished to have more access to computers, technical support, World Wide Web, e-mail, software, and manuals at the work environment. (6) *Distance education learning* included whether professors had used alternative media to learn, whether professors considered distance education an option for their own education, and which media they would be willing to use to take distance education courses: Internet, satellite or video.

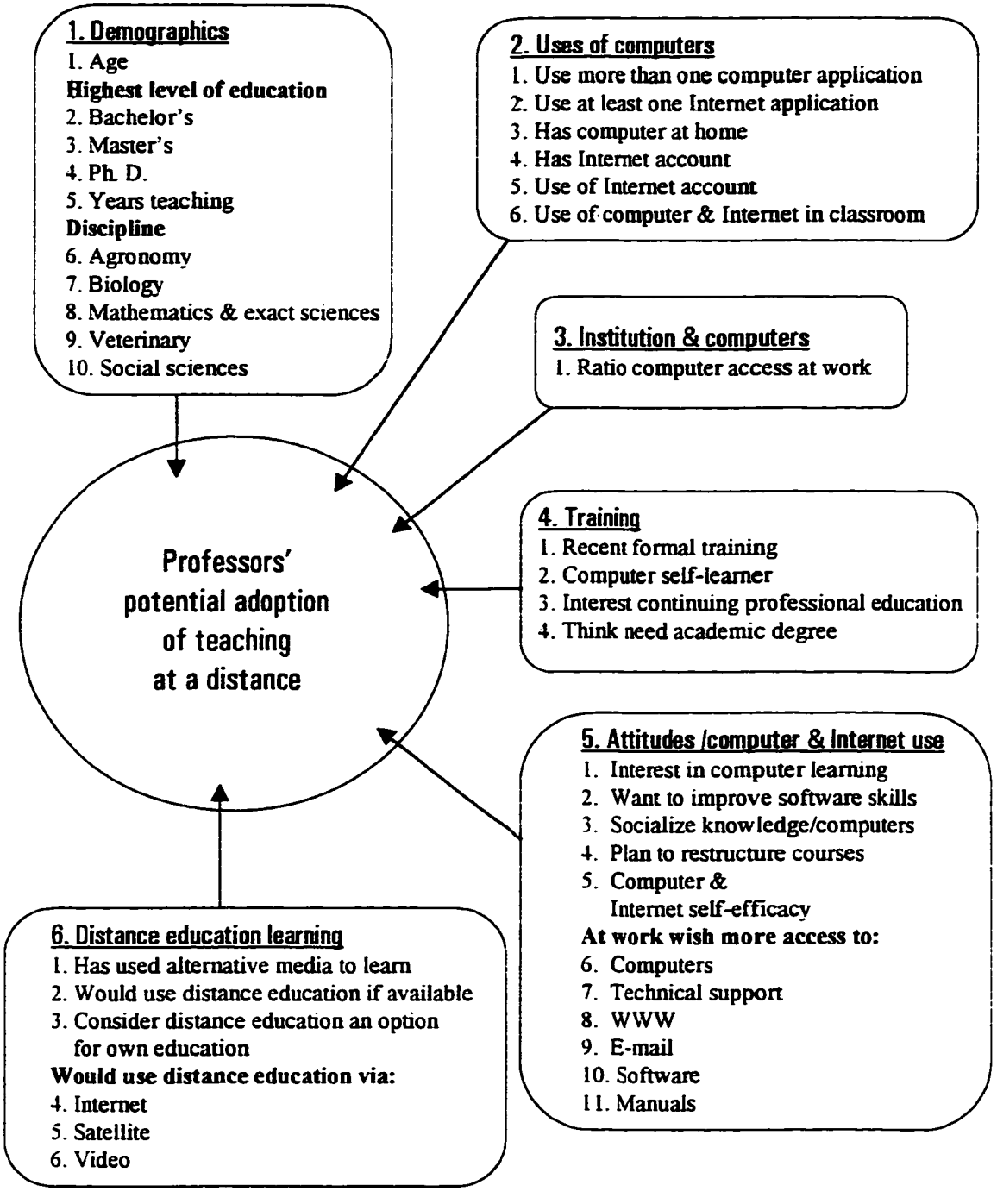

Figure 2.4 Model 3. Conceptual framework with factors related to professors' potential adoption of teaching at a distance.

CHAPTER III.
METHODS

Descriptive survey and associational research methods were used to meet the objectives of this study. Data collection and processing procedures are described in this chapter. All on-site research activities were conducted in Spanish. All interviews and data collection were done in agreement and collaboration with the CUCBA Center administration.

The specific objectives of the study were:

1. To identify College of Agriculture professors' interests in the use of computers for traditional and distance teaching.
2. To identify College of Agriculture professors' attitudes toward the use of computers for traditional teaching and for distance learning and teaching.
3. To identify College of Agriculture professors' self-efficacy levels in the use of computers for traditional teaching and for distance learning and teaching.
4. To identify the extent to which College of Agriculture professors currently use computers and electronic communications for teaching.
5. To describe the need for support for faculty development opportunities in subject matter, teaching methods, and degree seeking.
6. To assess faculty perceptions of the technical infrastructure and support systems available to College of Agriculture faculty.
7. To identify predictors of adoption of computers for traditional college teaching and for distance learning and teaching.

The Sample

This study was conducted in Guadalajara, Jalisco, Mexico (Figure 3.1), in the College of Agriculture at the University of Guadalajara. The target population included all full-time and selected part-time professors who taught at least one course in any of the majors offered by the College. A complete list of all technical and academic personnel was provided by the main administration of the College of Agriculture. The list contained 341 names. However, this official list did not reflect accurately who was teaching and who was not. The list had to be evaluated by the researcher through interviews with Department heads, secretaries and administrative personnel. In this way, the list was reduced to 234 names. These steps were taken to minimize frame error. All members of the population were surveyed.

Figure 3.1 Map of Mexico where Guadalajara city is located

Instrumentation

The data collection instrument was a questionnaire. The first draft of the questionnaire was created in January 1998. It was written in English to facilitate a review by faculty at Iowa State University. At this stage, decisions were made about areas to cover, and the way

questions should be written for clarity. The questionnaire was then translated into Spanish. A number of suggestions from the panel of experts were used to improve subsequent versions of the actual questionnaire in Spanish (see Appendix E). This final version was translated back to English for the purpose of this report (see Appendix D).

The questionnaire was designed to be answered individually by the respondents. It was divided into six sections and contained a total of one hundred items. Respondents had seven opportunities to volunteer information. There were three instruments embedded in the questionnaire that were developed specifically for this study.

In section one, the purpose was to seek information about the software that professors used. It was also used to determine training issues related to computers, and provided a list of the software that professors wanted to learn more about. This section sought information about the likelihood that professors would take part in training activities, and identified the last training activity respondents had attended to learn about computer use. There were fourteen items in this section.

Section two contained nineteen items. It sought information about the type and frequency of professors' computing activities and access to communications. It included questions such as whether professors have access to a computer at home, and how many people they have to share the computer with. Also, professors were asked about their Internet access, frequency or use, and support systems to which they would like to have more access. A space was provided for comments about equipment availability and access to communications.

Section three contained ten questions. The purpose of this section was to determine the use of computers by professors in college teaching. Questions referred to individuals' use of computers to prepare for classes, the use of e-mail or fax to deliver class materials, and the use of computers during the class period. Professors were asked if they would consider revamping their courses to facilitate more use of computers. Also an open space was provided for further comments about the use of computers in college teaching.

Section four was designed to provide a profile of professors' computer software and Internet self-efficacy. This "*Computer software and Internet self-efficacy instrument*" was developed using three instruments as guidance, one developed by Murphy, Coover, and Owen (1988), another by Delcourt and Kinzie (1993), and one by Faseyitan and Hirschbuhl (1992). The questionnaire designed by Murphy et al. (1988) used data from graduate students, adult vocational students, and nurses who were learning to use computers. Their "Computer self-efficacy" instrument is a 32-item scale to measure perceptions of capability regarding computer knowledge and skills, and it was based on Bandura's (1986) self-efficacy theory. Delcourt and Kinzie's questionnaire used data from undergraduate students, and was developed with similar purpose to Murphy et al.'s. The questionnaire developed by Faseyitan and Hirschbuhl (1992) was called "Faculty and instructional computing questionnaire." It was a 39-item instrument designed to obtain information on instructional computing activities of college faculty.

The "Computer software and Internet self-efficacy instrument" differs from the above described instruments in three aspects: (1) Internet- related issues were included, (2) translation into Spanish was needed since the actual survey was in Spanish, and (3) the

instrument used for this study was reduced in length to seventeen items. These items referred to skills needed to use computers, deal with moderate level problems, and the installation of software. Items related to the use of the Internet and the World Wide Web were also included. The self-efficacy instrument took the form of a 5-point Likert-type scale where 1 represented "not confident," 2 "a little confident," 3 "somewhat confident," 4 "confident," and 5 "most confident."

Section five was designed to determine how professors regard the use of technology for teaching and their level of readiness to continue self education. This section included an instrument where respondents were asked to react to the statement "If I were interested in continuing my education it would be because I want to . . . " Personal satisfaction, another degree, teaching skills, salary increment, and learn more about the subject area, were the possibilities to be rated from "not important" to "extremely important" on a scale 1 to 5. An open space was provided for comments about their opinion on the use of technology for teaching and on continuing self education. This section included twenty-seven items.

The purpose of the sixth section was to obtain demographic information. The section had thirteen items referring to gender, age, and educational level. Professors were also asked about their English skills, their experience taking the TOEFL test (Test Of English as a Foreign Language), and their teaching experience.

The questionnaire was approved by the Iowa State University Human Subjects Review Committee on February 9, 1998. A copy of the statement can be found in Appendix A.

Reliability and validity

Since the researcher was not physically in the location of the research, Guadalajara, Mexico (but in Ames, Iowa, U.S.A.), a special strategy was developed for establishing validity and for pilot-testing the questionnaire. In an attempt to control measurement error as a threat to internal validity, a panel of experts at Iowa State University reviewed the questionnaire for content and face validity by early February, 1998. This allowed the researcher to spend on-site time defining the list of respondents, and distributing the instrument.

The panel of experts for this part of the strategy included ten Spanish speaking graduate students at Iowa State University. These experts had previously been professors of agriculture at universities in Mexico and other Latin American universities. This panel of experts also helped to measure response time which was from fifteen to twenty minutes. The experts responded to the whole questionnaire on their own, and were then interviewed on a one-by-one basis. The experts expressed their concerns about specific items. This test highlighted problematic individual survey items and sections. Based on suggestions made by the expert panel, revisions were made to the questionnaire.

Five members in the panel of experts also completed the test-retest procedure for reliability purposes (Mueller, 1986). These panel members completed the questionnaire twice, with a period of four weeks between the first test and the second test. The first Spanish version of the questionnaire was used for the first test. The retest version of the questionnaire was an improved version based on input of the panel of experts. The final version of the questionnaire had one-hundred items, out of which only 37 were usable to compare the consistency of their answers. The agreement between the first and second test averaged 81%.

This test-retest procedure did not include the seventeen items in the self-efficacy instrument in section four.

The next stage in establishing validity was a second field test. In this stage the questionnaire was posted on the researcher's web-site in Adobe Acrobat "pdf" format. Selected professors at CUCBA Center were asked to download it and to provide comments via e-mail, telephone or fax. Four professors at CUCBA Center replied with comments and filled out the questionnaire. Again, pertinent corrections were made after this review. Revisions were mostly in the area of graphic design and computer-oriented language and wording. The researcher arrived in Guadalajara one week before administering the questionnaire and conducted a third and final review of the questionnaire with three professors.

After data concerning self-efficacy were collected, a Cronbach's alpha was used to estimate the internal consistency reliability of this instrument among all professors who responded, yielding a coefficient of 0.95. According to Mueller (1986), a well-constructed attitude scale may have a reliability coefficient of above .80.

Data Collection

The data for this study were collected from March 14 to May 30, 1998, in the College of Agriculture at the University of Guadalajara. During this time, professors received a cover letter and a copy of the questionnaire accompanied by a pen. The cover letter explained the nature of the survey and that it would take between fifteen and twenty minutes to complete. The letter also explained to professors that their participation was noncompulsory, it offered

confidentiality, and it indicated that the results would be available on the Internet. This cover letter was signed by the researcher and the Director of Academic Programs in the College of Agriculture, Martin Tena. A copy of the letter is found in Appendix C and an English translation is in Appendix B.

A non-monetary reward was given as an incentive to increase response rate (Figure 3.2). The incentive was a pen with the printed message: *Cultivando el Futuro. CUCBA. Universidad de Guadalajara.* (Cultivating the future. CUCBA. University of Guadalajara.)

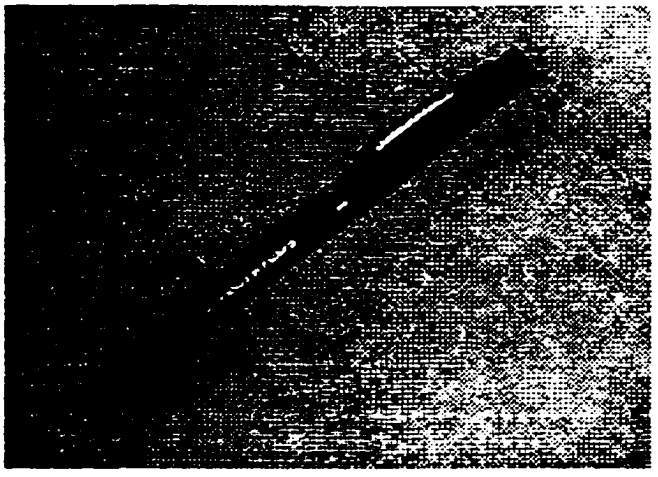

Figure 3.2 Pen distributed with the questionnaire as a non-monetary incentive to increase response rate.

The researcher decided to hand this pen out to professors with the questionnaire, and not as a reward for returning it. This decision about timing of the reward was supported by discussions held with the panel of experts, and by findings reported by Church (1993). Church found that there is a statistically significant effect in the response rate in mail surveys that included incentives in the initial mailing.

The pen helped to generate awareness of and interest in the study since it became a conversation topic among professors. This awareness facilitated the distribution process. Some professors came by themselves to the researcher's temporary office to pick up their pen and questionnaire. The message: "*Cultivando el Futuro. CUCBA. Universidad de Guadalajara*" was also printed on the front page of the questionnaire.

Most of the questionnaires were handed out personally by the researcher and support personnel in CUCBA Center when professors went to the Treasurer's office to collect their pay check on March 14, 1998. Professors who were not contacted this way were visited by the researcher in their offices. The visits provided an opportunity to explain the project to some professors and, thus, to increase response rate. Other professors were also reached via campus mail or through the heads of the departments. By the end of March, 234 questionnaires had been delivered. During April 1998 one written reminder and replacement instruments were sent to non-respondents.

Response

Completed questionnaires were returned to a central campus address. Out of the 234 delivered questionnaires, a total of 159 usable questionnaires were returned. This represents a response rate of 68%. Non-response error was controlled using the procedure of comparing early respondents to late respondents outlined by Miller and Smith (1983). "Early" respondents (n = 124) were determined to be those who returned the questionnaire within two weeks of the first delivery. "Late" respondents (n = 35) were those who returned the questionnaire anytime between two weeks after first delivery and May 30.

Early and late respondents were compared using five variables: (1) self-efficacy levels, (2) adoption of computer and use of the Internet in traditional teaching scale, (3) potential adoption of distance education for learning, (4) potential adoption of teaching at a distance, and (5) interest in further continuing professional education. No significant differences were found. These calculations lead the researcher to conclude that it is plausible to assume that respondents were similar to non-respondents, and the data could be generalized to the entire population.

Data Analysis

Data from the questionnaire were processed using statistical procedures and content analysis techniques. For the statistical procedures the researcher used SPSS, version 7.0 for Microsoft Windows 95. All respondents (159) volunteered information to at least one of the seven open ended questions. This information was processed using content analysis techniques. According to Berelson's (1952) classic definition, content analysis is a research technique for the objective, systematic, and quantitative description of the manifest content of communication. Responses were transcribed into a word processor. Then, the researcher looked for patterns to break responses into categories, and then recorded frequencies. Some responses had information that fit into only one category; others had information pertinent to two or more categories.

In this section each objective is presented followed by the procedures that were used to meet it.

1. To identify College of Agriculture professors' interests in the use of computers for traditional teaching and for distance learning and teaching.

Frequencies and percentages were used to describe (1) professors' interest in learning more about computer use; (2) whether professors were planning to restructure courses to use computers more than previously; and (3) professors' interest in teaching courses at a distance. Content analysis techniques were used for an open ended question to describe (4) the software that professors wanted to learn more about.

2. To identify College of Agriculture professors' attitudes toward the use of computers for traditional teaching and for distance learning and teaching.

Frequencies and percentages were used to describe (1) professors' willingness to improve computer skills; (2) whether professors considered distance education an option for their own education; (3) medium/media that professors used for learning; (4) whether they would use those media again; (5) willingness to take courses of interest at a distance if available; and (6) media preferred for distance education if available. Content analysis was used to summarize responses to the open-ended questions about: (7) the use of technology in college teaching; (8) the reasons why professors think distance education is/is not an option for their own education; (9) professors' attitudes about the use of technology in college teaching, and opportunities for education.

3. To identify College of Agriculture professors' self-efficacy levels in the use of computers for traditional teaching and for distance learning and teaching.

Means and standard deviations were used to summarize the data.

4. To identify the extent to which College of Agriculture professors currently use computers and electronic communications for teaching.

Frequencies and percentages were used to describe professors' (1) computer applications used, and (2) the extent to which computers and electronic communications were used in class preparation and delivery during the last semester.

5. To describe the need for support for faculty development in subject matter; teaching methods, and degree seeking.

Frequencies and percentages were used to measure professors' (1) interest in further continuing professional education, and (2) whether they think they need an additional academic degree. Means, and standard deviation were used to summarize (3) reasons for their interest in further education. The content analysis technique was used to summarize (4) the major obstacles to furthering their education, and (5) the subject areas in which they were interested for further education.

6. To assess the technical infrastructure and support systems available to College of Agriculture faculty as perceived by themselves.

Frequencies and percentages were used to describe professors' (1) computer self-directedness; (2) most recent formal training in computers; (3) access to computers at home, and (4) at work; (5) ratio of computers to users; (6) computer access desired; (7) having an e-mail account; (8) frequency of e-mail use; (9) socialization about technology; and (10) support system access desired. The content analysis technique was used for the open-ended question to describe (11) perceived access to equipment in the work place.

7. To identify predictors of adoption of computers for traditional college teaching and for distance learning and teaching.

The dependent variables for the three models were: (1) professors' use of computers and the Internet in classroom instruction, (2) professors' potential adoption of distance education for learning, and (3) professors' potential adoption of teaching at a distance. For the three models the strength of the association among variables was determined. This was done in order to avoid including variables that provide redundant information in further calculations. Then, for each model the dependent variable was correlated with the independent variables using Pearson's, point biserial, and biserial correlations to determine if significant relationships existed. Only those variables with significant ($p < .05$) correlations to the dependent variable were entered in further calculations. For Model 1, stepwise multiple linear regression was used to determine possible predicting variables. For Models 2 and 3, stepwise discriminant analysis was used to classify cases into the dependent variable groups, to establish which characteristics were important for distinguishing among the groups, and to evaluate the accuracy of the classification. The alpha level for the multiple linear regression, as well as for the discriminant analyses was set a-priori of .10.

CHAPTER IV.
RESULTS

This descriptive and associational study was conducted to identify factors that could predict professors' adoption of technology for traditional teaching and distance education for learning and teaching in the College of Agriculture at the University of Guadalajara. These factors involve professors' interests, attitudes, self-efficacy levels, use of technology, need for support for faculty development opportunities, and perceptions of availability of equipment and communications. The population of this study was all teaching faculty in the College of Agriculture. In total, 159 usable questionnaires were returned. This represented a response rate of 68% of the 234 professors in the frame. No significant differences were found between early and late respondents based on five of the thirty-two variables. Hence, results from the respondents are considered generalizable to the actual population of all professors in the College of Agriculture. The results are grouped by objective and presented here.

Demographic Characteristics

Most professors (89%, $n = 135$) reported holding a full-time appointment (Table 4.1). More than half of professors (58%, $n = 91$) indicated holding a master's degree as their maximum level of education. Slightly more than one fourth of professors (27%, $n = 43$) reported a bachelor's degree as their highest level of education (Table 4.2). The average age of professors was 38.67 years, with a standard deviation of 7.34, and a range of 37 years (Table 4.3). The average number of years in service was 9.90 years, with a standard deviation of 7.44, and ranged from less than one year to 30 years (Table 4.4). With respect to gender,

Table 4.1 Category of appointment reported by professors.

Category of appointment	f	%
Full-time	135	88.8
Half-time	11	7.2
Contracted by course	6	4.0
Total:	152	100.0

Table 4.2 Educational level reported by professors.

Level of education	f	%
Bachelor's	43	27.2
Master's	91	57.6
Ph.D.	24	15.2
Total:	158	100.0

Table 4.3 Age reported by professors.

Age in years	f	%
21-25	3	1.9
26-30	17	10.9
31-35	34	21.8
36-40	43	27.6
41-45	33	21.1
46-50	14	9.0
51-55	9	5.8
56-60	3	1.9
Total:	156	100.0

Note: Mean 38.67, SD = 7.34, Range 37.

most professors (74%, $n = 118$) were male (Table 4.5). With regard to subject area, less than half of the professors (43%, $n = 68$) considered their discipline to be best described as biological sciences, slightly less than one third (30%, $n = 48$) as agronomical sciences, and 17% ($n = 26$) as veterinary. Only 6% of professors ($n = 9$) were in the social sciences, and 4% ($n = 7$) were in the mathematic and exact sciences (Table 4.6).

Table 4.4 Years in service reported by professors.

Years in service	f	%
1-5	59	41.2
6-10	27	18.9
11-15	21	14.7
16-20	22	15.4
21-25	9	6.3
26-30	5	3.5
Total:	143	100.0

Note: Mean 9.9, SD = 7.44, Range 30.

Table 4.5 Gender reported by professors.

Gender	f	%
Male	118	74.2
Female	41	25.8
Total:	159	100.0

Table 4.6 Subject areas reported by professors.

Subject area	f	%
Biological sciences	68	43.0
Agronomical sciences	48	30.4
Veterinary	26	16.5
Social sciences	9	5.7
Mathematics and exact sciences	7	4.4
Total:	158	100.0

Professors were asked to judge their self-efficacy concerning proficiency in using English. Responses were represented in percentages. The average level of English proficiency for reading was 75%, with a standard deviation of 22.41; the averages for writing, listening and speaking were slightly more than fifty percent (Table 4.7). The majority of professors reported that they had not taken the Test of English as a Foreign Language (TOEFL) (82%, n =130). Out of the twenty-six (16%) professors who indicated they had taken this test, only 17 reported their scores which ranged from 439-575 points, with a mean of 516.71 and a standard deviation of 40.4.

Table 4.7 Percentages of proficiency in English reported by professors (n = 159).

Skill	Mean	SD
Reading	74.97	22.41
Writing	55.72	25.54
Listening	58.45	25.71
Speaking	52.28	28.18

Objective 1. To Identify College of Agriculture Professors' Interests in the Use of Computers for Traditional and Distance Teaching

Interest in learning more about computers

Professors were asked if they were interested in learning more about computer use. Three options were given. Most professors (90%, n = 141) selected "I am very interested." Only 8% (n = 13) selected "I am fairly interested," and 1% (n = 2) selected "I am not interested" (Table 4.8).

Table 4.8 Interest in learning more about computer use.

Interest	f	%
I am very interested	141	90.4
I am fairly interested	13	8.3
I am not interested	2	1.3
Total:	156	100.0

Plans to restructure courses

Professors were asked whether they were planning to restructure their courses to use computers more often than previously. This question sought an answer of yes or no. Three quarters of the professors (82%, n = 120) indicated "yes" (Table 4.9).

Interest in teaching at a distance

Professors were asked if they were interested in teaching courses at a distance. Three options were given. About half of the professors (49%, n = 75) selected "yes," and less than one-fourth (24%, n = 36) selected "no" (Table 4.10).

Table 4.9 Planning to restructure courses to increase use of computers.

Planning	f	%
Yes	120	81.6
No	27	18.4
Total:	147	100.0

Table 4.10 Interest in teaching at a distance.

Interest	f	%
Yes	74	48.7
I am not sure what this implies	42	27.6
No	36	23.7
Total:	152	100.0

Software of interest

Professors were asked an open-ended question to indicate which software programs they were interested in learning. Using content analysis techniques, it was identified that the vast majority (85%, n = 135) indicated at least one software program that they were interested in learning. Some professors mentioned only one software application, and some others two or more. In total, there were 341 reports of interest in learning selected software (Table 4.11).

Of these 341 reports, the most frequently mentioned type of software was Internet-based tools (25%, n = 84) with e-mail and the use of the Internet at the top of the list. The second most mentioned software was classified as statistical packages (20%, n = 68). This group was followed by graphic design software (12%, n = 40), and data processing (12%, n = 40). Electronic presentations (9%, n = 32), publication software (8%, n = 27), word processors (6%, n = 19), and subject matter oriented tools (3%, n = 9) were the groups with fewer mentions. Specific software packages that were mentioned more than fifteen times are (in descendent order) SAS, Excel, Power Point, SPSS, Corel Draw, and Page Maker.

Table 4.11 Software that professors desired to learn more about.

Group	Software	f	%
Internet-based Tools		**84**	**24.6**
	E-mail use	19	5.6
	Use of Internet	18	5.3
	Internet publishing	16	4.7
	Internet teaching	15	4.4
	Netscape	9	2.6
	Internet Explorer	7	2.0
Statistical Packages		**68**	**20.0**
	SAS	26	7.6
	Statistical packages	20	5.9
	SPSS	15	4.4
	Statgraphics	4	1.2
	Statistica	3	.9
Graphic Design		**40**	**11.7**
	Corel Draw	15	4.4
	Graphic design	10	3.0
	Auto CAD	5	1.5
	Harvard Graphics	6	1.8
	Adobe Photo-shop	3	.9
	Adobe Illustrator	1	.3
Data Processing		**40**	**11.7**
	Excel	22	6.4
	Access	7	2.0
	FoxPro	4	1.2
	Data processing	4	1.2
	QuatroPro	2	.6
	Lotus	1	.3
Electronic Presentation		**32**	**9.4**
	Power Point	22	6.4
	Corel Presentations	6	1.8
	Presentations software	4	1.2
Publication Software		**27**	**7.9**
	Page Maker	17	5.0
	Publication software	10	3.0

Continue...

Table 4.11 Software that professors desired to learn more about.

Group	Software	f	%
... continue			
Word Processors		**19**	**5.6**
	Word	13	3.8
	Word Perfect	2	.6
	Word processors	4	1.2
Subject Matter Oriented		**9**	**2.6**
	Nutrition feeds	2	.6
	GIS	2	.6
	Animal nutrit/ prod.	1	.3
	Project evaluation	1	.3
	Con Med	1	.3
	Taurus	1	.3
	Nucleic Acid	1	.3
Others		**22**	**6.5**
	Programming	5	1.5
	Arc-Info	4	1.2
	Arc-View	2	.6
	Windows	2	.6
	Mini-Tab	1	.3
	Paint	1	.3
	Corel Press	1	.3
	Maple IV	1	.3
	Macromedia	1	.3
	Visual Basic	1	.3
	Quark X-press	1	.3
	Office 7	1	.3
	Sigma-Plot	1	.3
	Grand total:	341	100.0

Objective 2. To Identify College of Agriculture Professors' Attitudes Toward The Use of Computers for Traditional Teaching and for Distance Learning and Teaching

To accomplish this objective, professors were asked sixteen questions about their attitudes toward the use of computers for traditional teaching, and for education at a distance.

Use of technology in college teaching

Professors were asked to write comments regarding the use of computers and electronic communications in college teaching. Content analysis was used to summarize their statements. More than half of the professors (52%, $n = 82$) provided information in this area. The largest category included 58 comments emphasizing the importance and need for the use of computers in teaching (70% of all comments). These comments were related to the benefits of the use of technology in education, the improvement of quality in teaching that computer technology can provide, and professors' desires to be able to practice more in this area. The comments were interwoven with the second largest category (48%, $n = 39$) that emphasized the lack of availability of equipment, and the old software available. Some other professors (17%, $n = 14$) emphasized the need for instruction, so they could be in a better position to incorporate technology in teaching. The smallest category (2%, $n = 2$) had comments pointing out the bad aspects of using technology such as "students copy files for homework," or the incompatibility of technology with their area: "my subject area does not need computers/communications."

Would like to improve skills in using software

Professors were asked if they would like to learn to use, or improve their skills in using some software. Most of the professors (99%, $n = 151$) indicated "yes."

Whether consider distance education as an option

Professors were asked if they considered "distance education" as an option for their own education. Over half the professors (60%, $n = 92$) selected "yes" (Table 4.12).

Table 4.12 Professors considering distance education as an option for their own education.

Distance education as an option	f	%
Yes	92	60.1
Don't know what this means	21	13.7
No	40	26.2
Total:	153	100.0

Why distance education is/is not an option

A follow-up open-ended question was asked for professors to elaborate on why they thought distance education was or was not an option for their own education. Content analysis was used to summarize responses. More than three quarters of the professors (78%, n = 124) volunteered information in this area. Responses (160) were in three directions: positive views of distance education, negative views, and "not sure" (Table 4.13).

The vast majority of comments were on the positive side (71%, n = 113). Issues related to time and self planning were the largest category (21%, n = 33). There were 15 comments (9%) related to the convenience and practicality of distance education programs, and also 15 comments related to the advantages of availability and opportunities that this system offers. Fifteen professors (9%) commented on the compatibility of this system with students' current life, followed by the advantage of avoiding commuting to attend classes, traveling and moving, with 11 entries (7 %). Nine professors (6%) mentioned that it is more economical, 6 (4%) indicated that it allows local research and self-regulation, 5 (3%)

mentioned the advantages this system has by allowing learners to know other people, programs, institutions and ideas, and 4 professors (2%) said that it is an interesting and creative alternative.

Less than one-fourth of the comments were in the area of negative attitudes (23%, n = 37). Professors' comments were expressed in seven categories. Nine professors (15%) stated that this system was impractical since education requires interaction. Eight professors (5 %) said that they prefer real-life experience in other universities. Eight professors stated

Table 4.13 Categories of responses to "why" professors think distance education is/is not an option for their own education.

Category		f	%
Positive attitudes		**113**	**70.9**
1.	Time and self planning.	33	20.7
2.	Practicality.	15	9.4
3.	Offers opportunities when attendance is not an (local) option.	15	9.4
4.	Allows the continuation of students' life (family, job).	15	9.4
5.	Reduces the need to travel.	11	6.9
6.	Economical.	9	5.7
7.	Allows local research and self-regulation	6	3.8
8.	Allows knowing other people, programs, institutions, or ideas.	5	3.1
9.	An interesting/creative alternative.	4	2.5
Negative attitudes		**37**	**23.3**
1.	Impractical, and lacks interaction.	9	5.7
2.	Prefer real life experience in other universities.	8	5.0
3.	Not formal education, lacks quality.	8	5.0
4.	Does not guarantee teaching/learning process (doesn't work).	4	2.5
5.	Personal relationships are fundamental.	4	2.5
6.	Students need more discipline.	3	1.9
7.	It is not compatible with students' busy lives.	1	.6
Don't know:			
1.	Need more experience/information to have an opinion	9	5.7
Total:		159	100.0

that they do not consider this to be formal education, and it lacks quality. Four professors (2%) indicated that the system does not guarantee the teaching/learning process (it doesn't work). Four professors indicated that personal relationships are fundamental. And three professors (2%) said that, as students, they need more discipline than the one implied in distance education programs.

Some professors' attitudes were expressed within a category "don't know." Ten of them (6 %) expressed the need for more information in order to have an opinion, or that they need to have experience in seeing how it works.

Media used for learning

Professors were asked to indicate, out of six, all the delivery methods they had used to take courses (as students). Most professors (77%, n = 123) had experienced at least one alternative medium for learning. Videotape was indicated as experienced by 67% (n = 107) of professors, television by 40% (n = 64), software or CD ROM by 25% (n = 40), and Internet by 12% (n = 20) (Table 4.14). Other media were listed by 13 professors including satellite,

Table 4.14 Media indicated by professors through which they have experienced learning (n =159).

Medium	f	%
Videotape	107	67
Television	64	40
Software or CD ROM	40	25
Internet	20	12
Radio	9	6

teleconference, printed materials, films, *telesecundaria* (a government program to deliver middle school to rural areas via television and printed materials), mail, manuals, and telephone conferences.

Would use those media again

Those professors who reported they had used some alternative media to take classes were asked to respond whether they would consider the use of those indicated media as an option for teaching/learning again. Responses were: "Absolutely yes I will consider these media as an option for teaching/learning again" (79%, $n = 99$), "I may consider these media as an option for teaching/learning again" (20%, $n = 25$), and "I will never consider these media as an option for teaching/ learning again" (0.8%, $n = 1$) was indicated by one professor who had used television and software.

Would take courses of interest at a distance if available

Professors were asked about their willingness to use education at a distance if available. More than three quarters of the professors (77%, $n = 121$) selected "yes" (Table 4.15).

Table 4.15 Would take course of interest at a distance if available.

Would take courses	f	%
Yes	121	77.1
Maybe	32	20.4
No	4	2.5
Total:	157	100.0

Media preferred for distance education if available

Professors were asked the medium/media through which they would be ready to take courses at a distance. Almost three quarters of the professors (71%, n = 114) indicated "Internet." More than half of professors (62%, n =99) indicated "satellite;" and "video" (57%, n = 91). One third of professors (33%, n = 53) indicated "correspondence" (Table 4.16).

Table 4.16 Media preferred to use distance education if available (n =159).

Media	f	%
Internet	114	71
Satellite	99	62
Video	91	57
Correspondence	53	33

Beliefs about technology for teaching and opportunities availability

Content analysis was used to summarize responses to an open-ended question that asked professors to comment on their beliefs regarding technology for teaching and the availability of opportunities for education. More than one third of the professors (34%, n = 54) volunteered information in this area. There were a total of 67 different comments which were divided into two categories, positive and negative. The positive comments totaled 56 (84%) in eleven categories. The most common category was: "there is the need to

experiment about how to use technology in the classroom" (21%, n =14); followed by the categories "technology facilitates teaching and enriches it" (12%, n = 8); "there is the need of more institutional support to use more technology in education" (9%, n = 6); "distance education systems solve current problems in education" (8%, n = 5); "education systems are changing to accommodate new needs" (5%, n = 3); "it is a very good option" (5%); "I am ready to start using it" (5%); "distance education systems are compatible with students' life" (5%); "technology is underutilized in education" (3%, n = 2); "it improves the speed of new information" (3%), and "it is the future of education" (3%). Other comments included: "there is ignorance of its potential," "it takes faculty development, preparation time, and more planning," "it is important to know the implications of these systems toward improving teaching," "I am very interested in using new technologies for teaching," and, "it needs to show its advantages in education."

There were some (17%, n = 11) negative comments. Four (6%) comments were in the category "distance education is a good alternative but is informal (lacks credibility)", and three comments (5%) in the category "it brings new inconveniences" (Table 4.17).

Other comments were: "electronic media will never substitute for face-to-face contact with experienced people," "poor people who cannot attend schools will not have computer access either," "educational problems are not in technology development, nor in quality or availability,"and "technology helps in education but should not be the only delivery mode."

Table 4.17 Categories of comments volunteered by professors on their beliefs regarding technology for teaching and the availability of opportunities for education (n = 67 comments).

Category		f	%
Positive attitudes		**56**	**83.5**
1.	Need to learn how to use technology in the classroom.	14	20.7
2.	Technology facilitates teaching and enriches it.	8	11.8
3.	Need more institutional support to use more technology in education.	6	9.0
		5	7.5
4.	Distance education systems solve current problems in education.	3	4.5
5.	Education systems are changing to accommodate new needs.	3	4.5
6.	Technology is a very good option.	3	4.5
7.	Ready to start using technology for teaching.	3	4.5
8.	Distance education systems are compatible with students' life.	2	3.0
9.	Technology is underutilized in education.	2	3.0
10.	Improves the speed of new information.	2	3.0
11.	Technology is the future of education.	5	7.5
Other comments.			
Negative attitudes		**11**	**16.5**
1.	Distance education is a good alternative but is informal (lacks credibility).	4	6.0
2.	New inconveniences.	3	4.5
Other comments.		4	6.0
Total:		67	100.0

Objective 3. To Identify College of Agriculture Professors' Self-efficacy Levels in the Use of Computers for Traditional Teaching and for Distance Learning and Teaching

Professors were asked to respond to seventeen items regarding their judgments of their own self-efficacy in using computers for traditional teaching, and for distance learning and teaching. Using a 5-point Likert-type scale, they were asked to indicate how confident they felt regarding the use of computers and the Internet. The scale equivalences were 1 = "not confident," 2 = "a little confident," 3 = "somewhat confident," 4 = "confident," and 5 = "most confident." The overall mean for professors' self-efficacy was 2.65 with a standard deviation of 0.97. The items that had the highest means were: "send e-mail" ($M = 3.23$, $SD = 1.45$), and "find specific information on the Internet" ($M = 3.21$, $SD = 1.35$). Those items with the lowest means were "creating a home-page" ($M = 1.63$, $SD = 0.97$), and "use a list-server and chat rooms"($M = 1.73$, $SD = 1.10$) (Table 4.18).

Objective 4. To Identify the Extent to Which College of Agriculture Professors Currently Use Computers and Electronic Communications for Teaching

To accomplish this objective, professors were asked seventeen specific questions about the extent to which College of Agriculture professors currently use computers and electronic communications in college teaching.

Table 4.18 Professors' judgments of their self-efficacy to use computers for traditional teaching, and for distance learning and teaching (n = 159).

Items:		n	M[a]	SD
1.	Troubleshoot computer problems	154	2.92	1.14
2.	Install software programs	155	2.49	1.33
3.	Understand computer hardware terminology	152	2.62	1.07
4.	Understand computer software terminology	150	2.73	1.03
5.	Send e-mail (with user friendly software)	155	3.23	1.49
6.	Forward e-mail	152	3.07	1.56
7.	Edit text before forwarding e-mail	154	2.99	1.45
8.	Attach files to a message	154	2.68	1.45
9.	Create a mailing list	153	2.68	1.40
10.	Use a list-server and chat rooms	150	1.73	1.10
11.	Find specific information on the Internet	154	3.21	1.35
12.	Use search engines such as Yahoo	150	3.20	1.48
13.	Understand how the Internet works	152	3.05	1.24
14.	Explain how the Internet information is stored.	150	2.34	1.19
15.	Create a home-page	152	1.63	.97
16.	Download files via Internet	151	2.28	1.28
17.	Explain how information is transmitted on the Internet	150	2.10	1.09

a= Grand mean = 2.65, SD= .97. Scale: 1= "not confident," 2= "a little confident," 3= "somewhat confident," 4= "confident," and 5= "most confident."

Computer applications used

Professors were asked to indicate which computer applications they used on a regular basis. It was found that the vast majority (81%, n =129) used two or more applications. Practically all of them (96%, n =151) used some sort of word processor (i.e., Word or Word Perfect). More than half (63%, n = 99) used software for electronic presentations (i.e., Power Point, Corel Presentations). Over half of the professors (54%, n = 86) used Internet browsers (i.e., Netscape, Internet Explorer), and 52% (n = 83) used some sort of electronic mail program (i.e., Eudora, Pegasus). Almost half the professors (43%, n = 68) used some sort of statistical packages (i.e., SAS, SPSS). Desktop publishing tools were used by 15% of professors (n = 26) (i.e., Page Maker, Ventura). Only 6% of professors (n = 10) used Internet publishing tools (i.e., Front Page, HoTMetaL), and 6% of professors used teaching tools over the Internet (i.e., TopClass, WebCT).

Frequency of use of technology in teaching

Professors were asked eight questions to indicate how frequently they used computers and electronic communications in class preparation and delivery during the last semester. The options were: "did not teach," "never," "once," "not frequently," "frequently," and "very frequently." When professors were asked whether they used computers in class, over one third of professors responded "never" (41%, n = 54) while almost one third (31%, n = 41) indicated "frequently" or "very frequently" (Table 4.19). When asked if they used computers for class preparation, 67% (n = 93) reported "frequently" or "very frequently." When asked whether they had asked students to use computers to do homework more than half (54%,

n = 75) indicated "frequently" or "very frequently." A large majority of professors (85%, n = 115) had "never" used e-mail to deliver class materials, nor had used it (73%, n = 117) to communicate with students. Also, most professors had never used the fax to communicate with students (93%, n = 127), nor had they used typed memos (60%, n = 90). Almost half of professors (43%, n = 63) had not used the telephone to communicate with students.

Table 4.19 Frequency of use of computers and electronic communications in class preparation and delivery by professors during the last semester (n = 159).

During the last semester ...	Never %	Once %	Not frequently %	Frequently %	Very frequently %	Total
1. When teaching, did you use computers during the class periods?	41	9	19	18	13	100
2. To prepare classes, did you use computers?	6	5	22	35	32	100
3. Did you ask your students to use computers to do homework?	16	6	24	39	15	100
4. Did you use e-mail to deliver class materials?	85	4	6	4	1	100
5. How often did you use fax to communicate with your students?	93	3	3	0	1	100
6. How often did you use e-mail to communicate with your students?	87	2	6	3	2	100
7. How often did you use telephone to communicate with your students?	43	12	32	6	7	100
8. How often did you use typed memos to communicate with your students?	60	8	18	8	6	100

Objective 5.to Describe the Need for Support for Faculty Development Opportunities in Subject Matter, Teaching Methods, and Degree Seeking

To accomplish this objective, ten questions were asked.

Interest in continuing professional education

Professors were asked if they were interested in continuing their professional education. Practically all (93%, n = 144) indicated "I am very interested" (Table 4.20).

Need for another academic degree

Professors were asked whether they thought they needed an additional academic degree. Most of them (87%, n = 138) indicated "yes" (Table 4.21).

Table 4.20 Interest in continuing professional education.

Interest	f	%
I am very interested	144	92.9
I am fairly interested	9	5.8
I am not interested	2	1.3
Total:	155	100.0

Table 4.21 Need for an additional academic degree.

Need degree	f	%
Yes	138	87.3
No	20	12.7
Total:	158	100.0

Importance of six reasons for continuing education

Professors were asked to indicate the level of importance of six possible reasons for them to continue their education. The response options ranged from 1-5 where 1 was "not important" and 5 was "extremely important." Means and standard deviations were calculated to summarize these data. The reason with the highest mean was "learn more about my subject area" (M = 4.60, SD = 0.58), and was followed by "keep up with news in my subject area" (M = 4.50, SD = 0.63), "be better at teaching" (M = 4.44, SD = 0.74), "get personal satisfaction" (M = 3.86, SD = 1.04), "get a higher pay in my job" (M = 3.61, SD = 1.10), and "get credits toward a masters'/doctorate degree" (M = 3.56, SD = 1.29) (Table 4.22).

Obstacles for continuing education

Content analysis was used to summarize an open-ended question that asked professors to indicate what they thought the major obstacles were to furthering their education. Most professors (84%, n = 134) volunteered at least one reason. There were a total of 170 different comments (Table 4.23). The category with most entries was "financial resources" (40%, n = 68) that included aspects such as lack of personal resources, lack of institutional support, and lack of scholarships. This was followed by the categories "lack of time" (26%, n = 45), and "work load" (9%, n = 16). Other categories were "language" (4%, n = 7), "lack of courses or programs available" (4%, n = 7), "I don't have obstacles" (4%, n = 7), "family and kids' education" (3%, n = 5), "age" (3%, n = 5), "other activities" (2%, n = 4), "lack of information" (2%, n = 3), "lack of respect for academia" (1%, n = 2), and "health" (1%, n = 1).

Table 4.22 Reasons for continuing education (n = 159).

Reason		M	SD
1.	Learn more about my subject area	4.60	.58
2.	Keep up with news in my subject area	4.50	.63
3.	Be better at teaching	4.40	.74
4.	Get personal satisfaction	3.86	1.04
5.	Get higher pay in my job	3.61	1.10
6.	Get credits toward a masters' /doctorate degree	3.56	1.29

Note: Scale 1= not important, 2=little important, 3= important, 4= very important, 5= extremely important.

Table 4.23 Summary of obstacles that professors reported to furthering their education.

Category		f	%
1.	Financial resources	68	40.0
2.	Time	45	26.5
3.	Work load	16	9.4
4.	Language	7	4.1
5.	Lack of courses/programs available	7	4.1
6.	Does not apply, (I don't have obstacles)	7	4.1
7.	Family, kids' education	5	2.9
8.	Age	5	2.9
9.	Other activities	4	2.4
10.	Lack of information	3	1.8
11.	Lack of respect for academia	2	1.2
12.	Health	1	.6
Total:		170	100.0

Subject areas desired for continuing education

Content analysis was also used to summarize an open ended question that asked professors to indicate the subject areas in which they were interested in further education. The majority of professors (88%, n = 140) volunteered at least one subject area with a total of 144 reports. These subject areas were organized in eight discipline areas (Table 4.24). The areas with most entries were Biology / chemistry with 36 entries (25%), followed by agronomy and crop sciences with 32 entries (22%), and natural resources and the environment with 27 entries (19%).

Table 4.24 Summary of all different subject areas in which professors were interested for further education.

Subject matter		f	%
1.	Biology / chemistry	36	25.0
2.	Agronomy / crop sciences	32	22.2
3.	Natural resources and the environment	27	18.8
4.	Social sciences	22	15.3
5.	Animal sciences	18	12.5
6.	Exact sciences	6	4.2
7.	Food sciences	2	1.4
8.	Art	1	0.7
Total:		144	100.0

Objective 6. To Assess Faculty Perceptions of the Technical Infrastructure and Support Systems Available to College of Agriculture Faculty

To accomplish this objective, nineteen questions were asked.

Computer self-learners

Professors were asked whether they received formal instruction in order to use the software they had indicated using. More than half (60%, $n = 91$) reported "yes."

Recent formal training in computers

Professors were asked when was the most recent formal training, workshop or seminar that they had attended to learn more about computer use. Six options were offered. About one quarter of the professors indicated "more than 2 years ago" (24%, $n = 38$). This was followed by "within the last 7-12 months"(22%, $n = 35$); "within the last 1-2 years" (22%, $n = 34$); "within the last 6 months" (16%, $n = 25$); and "never" (11%, $n = 17$). Only 6% of the professors ($n = 9$) indicated "currently I am attending one" (Table 4.25).

Access to a computer at home

Professors were asked whether they had access to a computer at home. Almost three quarters of the professors (72%, $n = 115$) indicated "yes."

Table 4.25 The most recent formal training in computers.

Last formal training		f	%
1.	More than 2 years ago	38	24.1
2.	Within the last 7-12 months	35	22.2
3.	Within the last 12-24 months	34	21.5
4.	Within the last 6 months	25	15.8
5.	Never	17	10.8
6.	Currently	9	5.6
Total:		158	100.0

Access to a computer at work

Professors were asked to indicate how easily they could access a computer at work. Four options were given. The largest group (43%, $n = 68$) was of those who indicated "It is about sufficient." About one quarter of professors (26%, $n = 41$) indicated "it is more than sufficient;" and nearly a quarter (24%, $n = 38$) indicated "it is insufficient." Only 7.5% ($n = 12$) of the professors indicated "I don't have access to a computer at work" (Table 4.26).

Ratio computer/user

In this same area of access to computers at work, professors were asked to indicate with how many people they had to share one computer. The largest group (35%, $n = 56$) was of those who indicated myself "and another 2-4 people." This was followed by the group of those who indicated sharing one computer with "more than 4 others" (28%, $n = 45$); those who share one computer with only "one more person"(15%, $n = 24$); those who had one computer for personal use (11%, $n = 18$); those who "do not have access to a computer in the work area" (3%, $n = 4$), and those who "use the Computation Center" (4%, $n = 7$).

Table 4.26 Access to computers reported by professors.

Levels of access		f	%
1.	About sufficient	68	42.8
2.	More than sufficient	41	25.8
3.	Insufficient	38	23.9
4.	No access	12	7.5
Total:		159	100.0

Computer access desired

Continuing in the area of access to computers at work, professors were asked to indicate those statements that best described how they felt about computer access at work. Four options were given. The largest group (58%, $n = 92$) was of those who indicated "at work I would like to have more access to a computer," followed by the group of those who indicated "I have all the access to a computer that I need" (38%, $n = 61$), and the group of those who indicated "I do not need a computer to do my work" (6%, $n = 9$). The smallest group was of those who indicated "at work I do have access to a computer but I don't use it" (4%, $n = 6$).

Having e-mail account

Professors were asked whether they had an Internet e-mail address either at work or personally. More than half (63%, $n = 101$) indicated "yes."

Frequency of e-mail use

Professors were asked the frequency with which they used their Internet account during the last four weeks. Six options were presented which were divided into two groups. The largest group (52%, $n = 84$) was of those who indicated that they used their account once a week or more and were considered to be "users." Non-users (45%, $n = 72$) were those who did not have an account, or used it once a month or never (Table 4.27).

Table 4.27 Classification of the Internet account users and non-users according to the professors' intensity of use.

Class	Frequency of use	f	%
Users	used their account regularly	43	27.6
	at least 3 times each week	26	16.7
	once a week	15	9.5
	Total:	84	53.8
Non-users	once during the last month	9	5.8
	never use their account	10	6.4
	do not have an Internet account	53	34.0
	Total:	72	46.2
Total:		156	100.0

Socialization about technology

Professors were asked whether they had communication with people with whom they could share experiences and knowledge about computers, or ask about troubleshooting. The majority (73%, n = 117) indicated "yes."

Support systems and access desired

Professors were asked to indicate the support systems, equipment and communications to which they desired more access. "Technical support" was the item selected by most of the professors (65%, n = 104), and was followed by "more software programs" (58%, n = 93), "computers" (51%, n = 81), "e-mail" (43%, n = 69), "manuals" (39%, n = 63), and access to the "World Wide Web" (33%, n = 53) (Table 4.28).

Table 4.28 Support systems equipment and communications to which professors desired more access.

Support system / equipment		f	%
1.	Technical support	104	65
2.	Software programs	93	58
3.	Computers	81	51
4.	E-mail	69	43
5.	Manuals	63	39
6.	World Wide Web	53	33

Perceived access to equipment in the work place

Content analysis was used to summarize professors' comments about access to and availability of computers in the work place. Almost half of the professors (42%, $n = 67$) volunteered information. Most of the comments (71) were in the area of poor circumstances which was divided into four areas: availability of resources such as equipment, software and communications (69%, $n = 49$); need more technical support (8%, $n = 6$); equity in distribution of the resources (8%, $n = 6$); and need more courses and training programs (10%, $n = 7$). On the positive side there were 3 comments (4%) suggesting a good level of availability of equipment.

Objective 7. To Identify Predictors of Adoption of Computers for Traditional College Teaching and for Distance Learning and Teaching

Three models were proposed to predict adoption of computers for traditional college teaching and for distance learning and teaching. Independent variables were selected based on

their potential to be good predictors of the dependent variable. The independent variables that were at the nominal level such as professors' level of education and discipline were coded into a set of dummy variables (Norušis, 1990). For example, for levels of education, a set of dichotomous variables was created. A two-category variable was used to indicate whether a professor's highest level of education was the bachelor's degree. Another two-category variable was used to indicate whether a professor's highest level of education was the masters' degree, and the same procedure was used for Ph.D. holders . For the three models, all independent variables were correlated. This was done to detect variables highly intercorrelated. It was decided that independent variables correlated at .80 or higher would present the problem of multicollinearity. No correlations above .80 were found.

Model 1

For this model, the researcher was trying to predict adoption of computers and the Internet for classroom instruction. This variable was measured using a 5-point Likert-type scale. Scale values ranged from 1 = "never," to 5 = "very frequently." Items included in the scale were as follows: the frequency with which professors (1) used computers in teaching classes, (2) used computers to prepare classes, (3) asked students to use computers to do assignments, (4) used email to deliver class materials, and (5) used email to communicate with students. The mean was 2.48 with a standard deviation of .76.

Since this was an exploratory study, twenty-nine independent variables were selected for consideration in a stepwise multiple linear regression. For the same reason, the significance level was set at .10. First, the independent variables were correlated with the dependent

variable using Pearson's, point biserial, and biserial correlations. Only eleven variables (Figure 4.1) were significantly correlated with adoption of computers and the Internet for classroom instruction. The variables with significant correlations were: professors' (1) holding the bachelor's degree, (2) use of more than one computer application, (3) use of at least one Internet application, (4) having an Internet account, (5) use of the Internet account, (6) having had institutional access to a computer, (7) have had recent formal training, (8) socializing knowledge about computers, (9) planning to restructure courses for more use of computers, (10) self-efficacy levels, and (11) wanting more access to software. According to Davis's (1971) description of the magnitude of correlations, these ranged from low to moderate.

With these eleven independent variables that were significantly related to the dependent variable a multiple linear regression analysis was done to identify a subset of independent variables that could be used to predict the outcome. It was determined that four variables explained a statistically significant unique proportion of the variation in the outcome. These were (1) self-efficacy scores, (2) being able to socialize experiences and knowledge or ask about computer troubleshooting, (3) professors' use of the Internet account, and (4) whether professors were planning to restructure course to increase their use of computers in the classroom, with an R Square = .18 (Table 4.29).

Table 4.29 Model 1. Stepwise multiple regression of adoption of computers and the Internet in classroom instruction on the significant independent variables.

Independent variables	R^2	R^2 Change
Computer self-efficacy score	.11	.11
Socialize knowledge about computers	.15	.04
Use of Internet account	.16	.01
Plan to restructure courses for more computer use	.18	.02

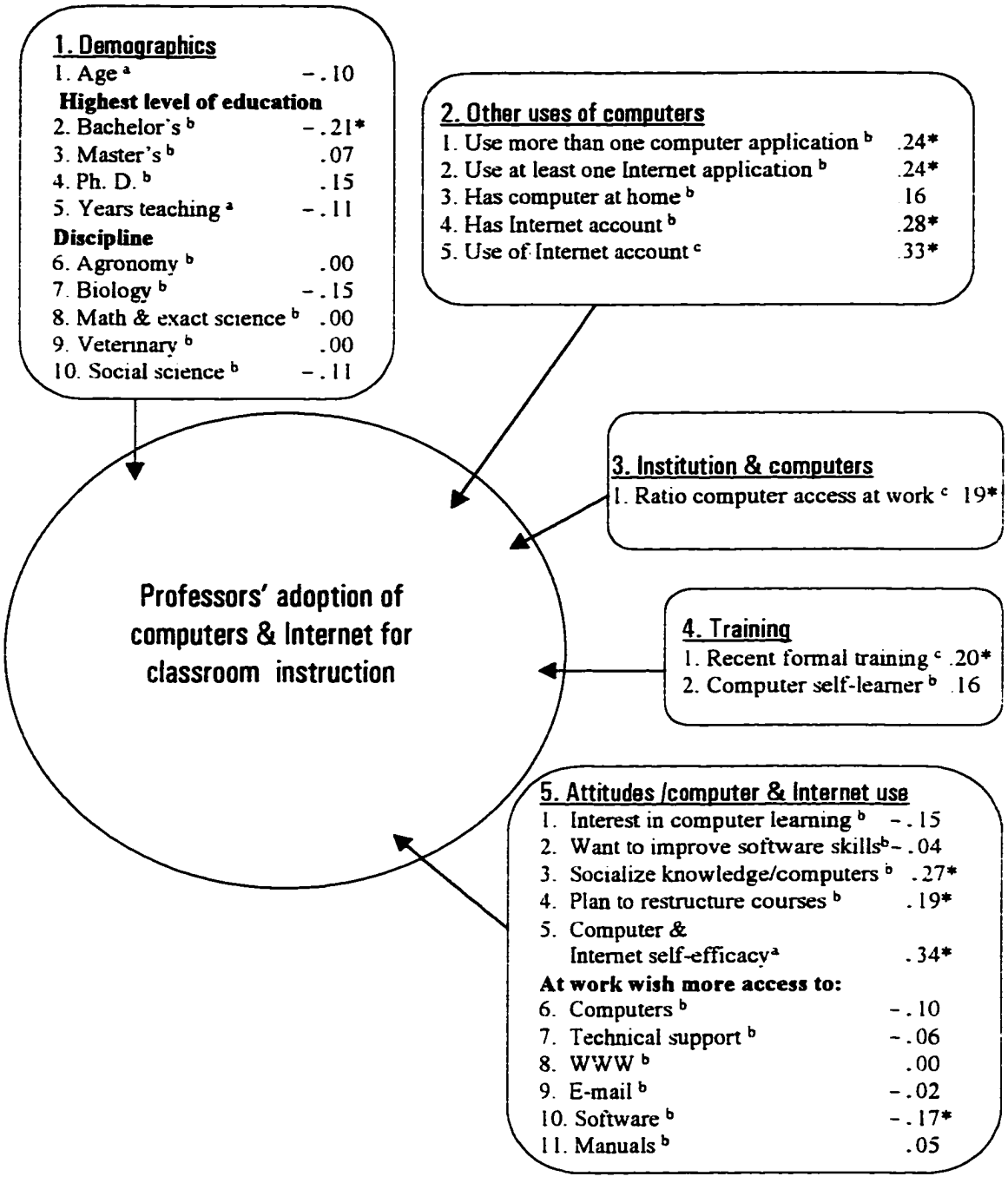

Figure 4.1 Model 1. Variables used to predict professors' adoption of computers and the Internet in classroom instruction, and their correlations with the dependent variable. *p<.05

Note. a= product moment coefficient of correlation, b= point biserial correlation, c= biserial correlation

Model 2

The outcome (dependent variable) that the researcher was trying to predict in this model was professors' potential adoption of distance education for learning. This was measured by the professors' response to the question "Do you consider distance education as an option for your own education?" This was a dichotomus variable with "yes" = 1 (60%, $n = 92$), and "no" = 0 (26%, $n = 40$).

Because of the exploratory nature of the study, thirty-six independent variables were examined for possible relationships with professors' potential adoption of distance education for learning. Of these thirty-six variables, only sixteen had significant correlations with the dependent variable (Figure 4.2). According to Davis's (1971) description of the magnitude of correlations, these ranged from low to moderate.

Discriminant analysis was used to determine if a linear combination of the sixteen significantly correlated variables could be used to predict adoption of distance education for learning. Discriminant analysis allows one to study the differences between two groups with respect to several variables simultaneously (Klecka, 1980). The goal was to classify cases into one of two mutually exclusive groups. The two groups were separated by the mutually exclusive distinction between potential adopters ($n = 92$) and non-potential adopters ($n = 40$). Out of 159 cases, only 109 were used in the discriminant analysis, due to missing data in the discriminating variables. Of these, 35 belonged to the non-potential adopters group and 74 to the potential adopters group. For the classification of all professors, a mean substitution was used for missing data. A stepwise procedure was used in the discriminant analysis because of

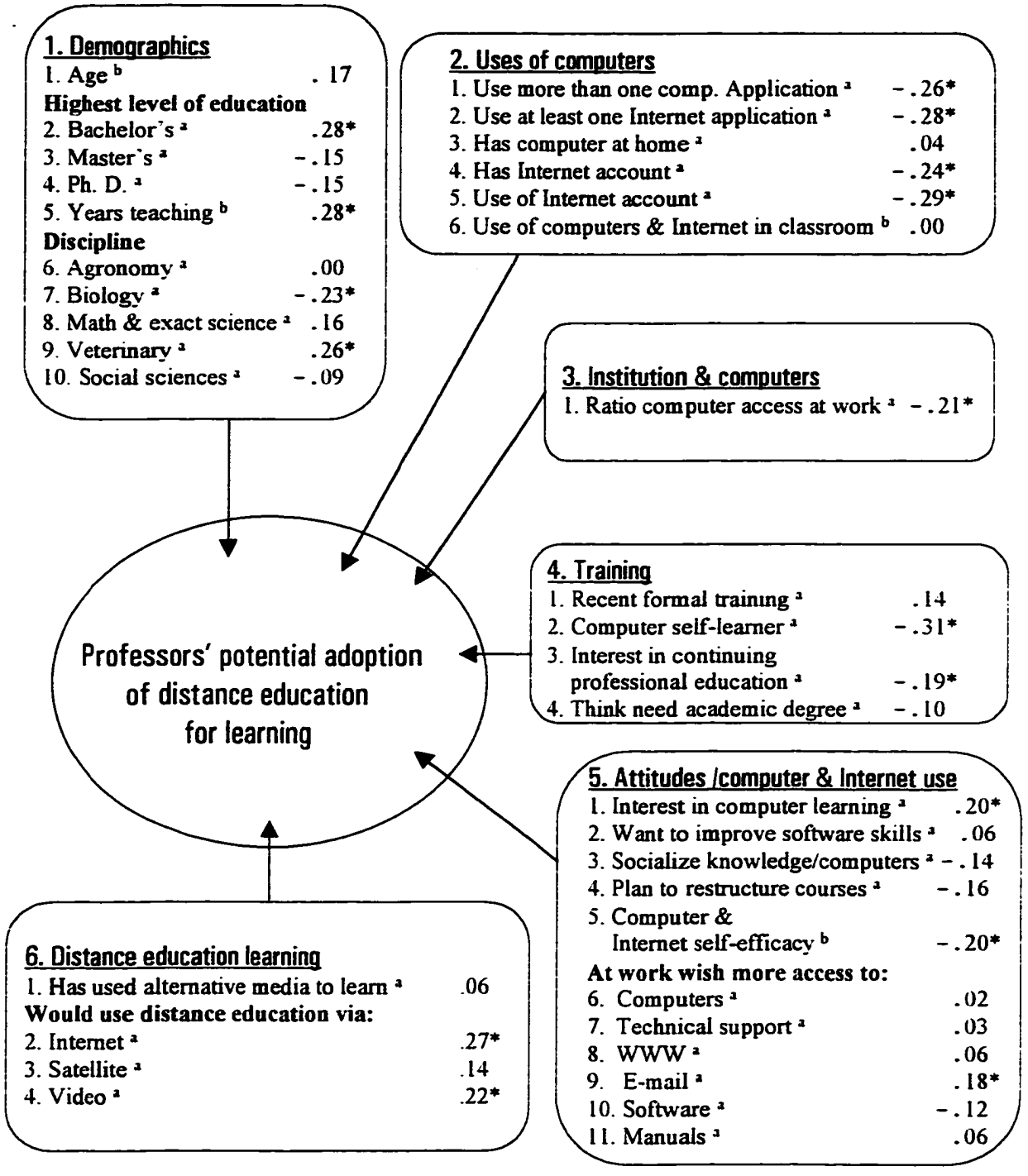

Figure 4.2 Model 2. Variables used to predict professors' potential adoption of distance education for learning, and their correlations with the dependent variable. *p<.05

Note. a= phi coefficient, b= point biserial correlation.

the exploratory nature of the study. For the same reason, the significance level was set at .10. Potential adopters and non-potential adopters were compared on the seventeen independent variables selected for the discriminant analysis procedure (Table 4.30).

The procedure resulted in the selection of five discriminating variables. The mean discriminant score (centroid) for potential adopters (.46) was significantly different from the mean discriminant score for non-potential adopters (-.98) (Wilks' Lambda = .68, Chi-square = 39.78, (5 df) $p<.10$) . The eigenvalue was .46 and the canonical correlation was .56.

Table 4.30 Model 2. Comparison of characteristics of potential and non-potential adopters of distance education for learning.

	Potential adopters n= 92		Non-potential adopters n = 40	
Variables	f	%	f	%
1. Use of more than one computer application	69	75.0	39	97.1
2. Use of at least one Internet application	51	55.4	34	85.0
3. Having Internet account	50	54.3	32	80.0
4. Use Internet account	40	43.5	30	75.0
5. Holding bachelor's degree	32	34.8	3	7.5
6. Interest in continuing professional education	88	95.7	38	95.0
7. Subject matter: biology	29	31.5	22	55.0
8. Subject matter: veterinary	22	23.9	1	2.5
9. Would use distance education for learning via Internet	76	82.6	23	57.5
10. Would use distance education for learning via video	59	64.1	16	40.0
11. Have access to computers at work	22	23.9	18	45.0
12. Interest in computer learning	90	97.8	37	92.5
13. Wish more access to e-mail	45	48.9	12	30.0
14. Computer self-learner (no need instruction to use comp.)	30	32.6	27	67.5
	Mean	SD	Mean	SD
15. Computer self-efficacy score	2.59	.95	2.95	.96
16. Years teaching	11.93	7.31	7.31	6.34

The most distinguishing characteristics of potential adopters of distance education for learning, when compared with non-potential adopters, can be determined by examining the standardized discriminant function coefficients (Table 4.31). Results show that potential adopters' highest level of education was a bachelor's degree, their subject matter discipline was best described as veterinary, they were more likely to choose distance education for learning via the Internet, and more likely to have been teaching for more years than those who were not potential adopters of distance education for learning. Also, those professors who reported not needing formal instruction to learn about computers (self-directed learners) were less likely to be potential adopters of distance education for learning.

The discriminant function resulted in an overall correct classification rate of 77% (Table 4.32). Potential adopters of distance education for learning were correctly classified 79% of the time, while non-potential adopters were correctly classified 70% of the time. Random assignment of professors to adoption groups would result in correct classification 50% of the time. Classification of professors using the five discriminating variables resulted in 53% fewer errors than would be expected from random classification (tau = .53).

Model 3

The outcome that the researcher was trying to predict in Model 3 was professors' potential adoption of teaching at a distance. This was measured by the professors' response to the question "Do you think you are interested in teaching courses at a distance?" This was a dichotomus variable with "yes" = 1 (49%, $n = 74$), and "no" = 0 (24%, $n = 36$). The option "I am not sure what this implies" (28%, $n = 42$) was not included.

Table 4.31 Model 2. Summary of data from the discriminant analysis procedure.

Variables	b	s	Group	Centroids
1. Held the bachelor's degree	.46	.49	Potential adopters	.46
2. Years teaching	.35	.44	Non-potential adopters	-.98
3. Subject matter discipline: veterinary	.45	.47		
4. Would use distance education for learning via Internet	.50	.37		
5. Computer self-directed learner	-.42	-.53		
Eigenvalue	R_c		Wilks' Lambda	p
.46	.56		.68	<.10

Note: b = standardized canonical discriminant function coefficient; s = within-groups structure coefficient; R_c = canonical correlation coefficient.

Table 4.32 Model 2. Classification of cases of potential and non-potential adopters of distance education for learning.

Actual group	Number of cases	Predicted group			
		Non-potential adopters		Potential adopters	
		n	%	n	%
Non-potential adopters	40	28	70	12	30
Potential adopters	92	19	21	73	79

Percent of cases correctly classified: 76.5%

Due to the exploratory nature of the study, thirty-seven variables were examined for possible relationship with the dependent variable. Of these thirty-seven variables, only ten had significant correlations with the dependent variable (Figure 4.3). According to Davis's (1971) descriptors, the magnitude these correlations ranged from low to moderate.

As in Model 2, discriminant analysis was used to determine the linear combination of these ten significantly correlated variables that most accurately predicted the dependent variable. The goal was to classify cases into one of the two mutually exclusive groups. The two groups were separated by the distinction between potential adopters (n = 74) and

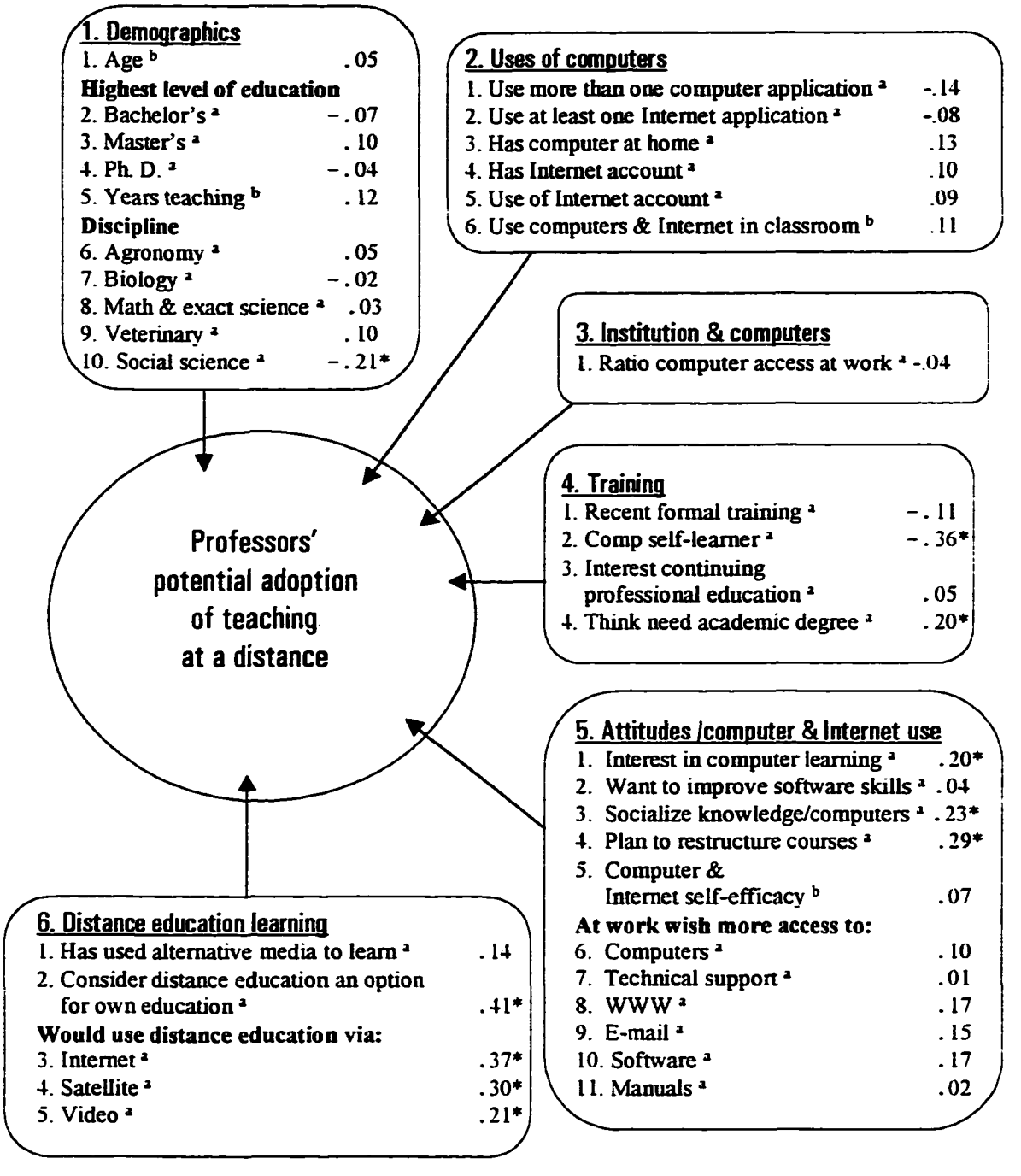

Figure 4.3 Model 3. Variables used to predict professors' potential adoption of teaching at a distance, and their correlations with the dependent variable. *p<.05.

Note. a = phi coefficient, b = point biserial.

non-potential adopters ($n = 36$) of teaching at a distance based on their answer to the question "Do you think you are interested in teaching courses at a distance?" Due to missing data on the discriminating variables, only 92 of the 159 cases were used in the discriminant analysis. Of these, 30 belonged to the non-potential adopters group, and 62 belonged to the potential adopters group. For the classification of all professors, a mean substitution was used for missing data. A stepwise procedure was used in the discriminant analysis because of the exploratory nature of the study. For the same reason, the significance level was set at .10. Potential adopters and non-potential adopters were compared on the ten independent variables selected for the discriminant analysis procedure (Table 4.33).

The procedure resulted in the selection of seven discriminating variables from the ten included in the analysis. The mean discriminant score (centroid) for the potential adopters (.57) was significantly different from the mean discriminant score for non-potential adopters (-1.19) (Wilks' Lambda = .59, Chi-square (7 df) = 45.6, $p < .10$. The eigenvalue was .69 and the canonical correlation was .64. The most distinguishing characteristics of potential adopters, when compared with non-potential adopters, can be determined by examining the standardized discriminant function coefficients (Table 4.34).

Results show that potential adopters of teaching at a distance were more likely to consider distance education as an option for their own learning, and would more likely choose distance education for learning via satellite, as well as the Internet. They were also more likely to be able to have contact with people with whom they can share experiences and knowledge about computers, or ask about troubleshooting (socialize knowledge) computer problems. Potential adopters were more likely to consider restructuring their courses to

Table 4.33 Model 3. Comparison of characteristics of potential and non-potential adopters of teaching at a distance.

Variables	Potential adopters n= 74		Non-potential adopters n = 36	
	f	%	f	%
1. Computer self-learner	24	32.4	26	72.2
2. Think need academic degree	68	91.9	28	77.8
3. Interest in computer learning	74	100.0	33	91.7
4. Socialize knowledge about computers	63	85.1	24	66.7
5. Plan to restructure courses for more use of computers	63	85.1	22	61.1
6. Would use distance education for learning via the Internet	64	86.5	19	52.7
7. Would use distance education for learning via satellite	54	73.0	15	41.7
8. Would use distance education for learning via video	49	66.2	16	44.4
9. Consider distance education an option for own education	56	75.7	13	36.1
10. Subject matter: social sciences	2	2.7	5	13.9

Table 4.34 Model 3. Summary of data from the discriminant analysis procedure.

Variables	b	s	Group	Centroids
1. Computer self-learner	-.44	-.43	Potential adopters	.57
2. Socialize knowledge about computers	.41	.25	Non-potential adopters	-1.19
3. Plan to restructure courses for more computer use	.39	.41		
4. Subject matter discipline: sociology	-.36	-.33		
5. Consider distance education an option for own education	.35	.53		
6. Would choose distance education for learning via Internet	.34	.40		
7. Would choose distance education for learning via satellite	.28	.38		
Eigenvalue	R_c		Wilks' Lambda	p
.69	.64		.59	<.10

Note: b= standardized canonical discriminant function coefficient; s= within-groups structure coefficient; R_c = canonical correlation coefficient.

incorporate more use of computers. Potential adopters were less likely to have sociology as their subject matter discipline, and were less likely to be computer self-learners.

The discriminant function resulted in an overall correct classification rate of 81% (Table 4.35). Potential adopters of teaching at a distance were correctly classified 84% of the time while professors who are non-potential adopters were correctly classified 75% of the time. Random assignment of professors to adoption groups would result in correct classification 50% of the time. Classification of professors using the five discriminating variables resulted in 62% fewer errors than would be expected from random classification (tau = .62).

Table 4.35 Model 3. Classification of cases of potential and non-potential adopters of teaching at a distance.

Actual group	Number of cases	Predicted group			
		Non-potential adopters		Potential adopters	
		n	%	n	%
Non-potential adopters	36	27	75	9	25
Potential adopters	74	12	16	62	84

Percent of cases correctly classified: 81%

CHAPTER V.
SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The University of Guadalajara (U of G) is the public university in the state of Jalisco, Mexico, with an enrollment close to 50,000 students at the higher education level. In the U of G's college of Agriculture, close to half of the academic staff hold only the bachelor's degree as the highest level of education. The conventional mechanisms followed so far to improve the academic level of professors offer little hope in the short term. This situation calls for the analysis of alternative educational programs that include the use of information technologies that accommodate the local circumstance.

This descriptive and associational study investigated whether personal and institutional characteristics of professors in the College of Agriculture in Guadalajara were related to the use of computers for traditional teaching and for distance learning and teaching. These characteristics included: interest, attitudes, self-efficacy levels, uses, need for support for faculty development opportunities, and availability of equipment and communications. Furthermore, the study sought to identify predictors of adoption of use of computers for traditional college teaching, and for distance learning and teaching. Based on the literature review, three models were developed to predict: (1) professors' adoption of computers and the Internet in classroom instruction, (2) professors' potential adoption of distance education for learning, and (3) professors' potential adoption of teaching at a distance.

To meet the objectives of this study a questionnaire in Spanish was designed to gather data from professors and academic staff. During March-May 1998 a survey of all 234

professors in the College of Agriculture Guadalajara, Jalisco, Mexico was conducted. The return rate was 68%. No significant differences were found between early and late respondents, hence, results from the respondents were considered generalizable to the actual population of all professors in the College of Agriculture. Descriptive, and associational statistical procedures, as well as content analysis techniques, were used to analyze the data.

The information generated through this study should be of significance for future faculty development opportunities in the College of Agriculture that concern both administrators and prospective participants. This information should also be of relevance to agriculture-related distance education projects under development at the national, and the international settings. Also, this study should contribute to the body of knowledge required in the decision making process in the practice of distance education, as well as in theory building in distance education.

Demographics

Professors in the College of Agriculture were predominantly male (74%), with a full-time position (89%). The average age was 39 years (*SD*= 7.5). The average number of years in service was 9.90 years (SD=7.44) and ranged from 1 to 30 years, however 41% had less than 5 years of service. The maximum level of education reported by more than half of professors (58%) was the master's degree, followed by the bachelor's degree (27%), and the Ph.D. degree (15%). On average, professors judged themselves capable of reading English (self-efficacy level) at the 75% level, and writing, listening and speaking at about the 55% level. Only 16% reported having taken the Test of English as a Foreign Language (TOEFL).

Interest

Most professors (90%) reported an interest in learning more about computer use, and wanted to learn more about at least one software application (85%). Internet-based tools (25%), and statistical packages (20%) were the applications more frequently mentioned as software professors wanted to learn more about. Most professors (82%) were planning to restructure their courses to incorporate more use of computers. However, only half of professors (49%) indicated an interest in teaching at a distance.

Attitudes

Most professors (99%) indicated they would like to improve their skills in the use of software. Half of the professors issued an opinion regarding the use of technology in the classroom, and 70% of these comments were in favor of the incorporation. They also emphasized the importance and need for technology in the classroom. Their comments showed that professors were familiar with the topic and knew what the incorporation of technology could do to improve the teaching and learning process. Comments showed a desire to have more opportunity for hands-on experience. Also, professors believed that modernization of education was imperative.

With regard to distance education for their own learning, the majority of professors (60%) indicated they considered it to be an option. Most professors (78%) issued an explanation of their opinions of the distance education system. Most of these comments (71%) were on the positive side. The most common reasons why they believed that distance

education was a good option were in the area of better use of time and self planning. Again, the comments indicated a familiarity of the professors with the use of distance education.

Most professors (77%) had already had experience using alternative media for learning. Practically all of those who had experience indicated their willingness to use alternative media again for learning (79%). The media that had been used by most professors were: videotapes (67%) and television (40%). Furthermore, most professors (77%) indicated that if a desired course were available at a distance they would take it. Internet was the most highly selected medium (71%) through which professors would be willing to take courses at a distance.

Self-efficacy

On a scale of 1-5 (from "not confident" to "most confident"), the professors' self-efficacy mean score was 2.65 (SD = .97). Self-efficacy scores had a significant moderate positive correlation (.34) with the use of technology in the classroom. However, self-efficacy had a significant low negative correlation (-.20) with the potential to adopt distance education for learning, and a negligible correlation (.07) with potential adoption of distance education for teaching.

Current use of computers and electronic communications for teaching

It was already mentioned in the area of interest and attitudes that professors were aware of the benefits of integrating technology into teaching. They showed interest in, and had a positive attitude toward the use of technology in education. However, professors also mentioned their frustration because of the lack of access to good equipment and

communication. This constitutes a barrier for more and better use of the resources potentially available.

Most professors (81%) indicated they use two computer applications or more. Word processing was the most commonly used software (96%), followed by electronic presentations (63%). Concerning the use of computers in teaching, 34% of professors had never used computers during the class period while 31% had used them frequently. Computers were used for class preparation frequently by 67% of the professors. The majority of professors (54%) had frequently asked students to use computers for class assignments. A vast majority of professors (85%) had never used e-mail for class material delivery, nor had they ever used e-mail for communication with students (87%). This might be influenced by the low level of access reported for both professors and students. The use of fax, telephone, and typed memos to communicate with students were not common practices.

Adoption of computers and the Internet in classroom instruction was a composite variable made up of five variables related to uses of technology for instruction. On a scale of 1-5, the mean was 2.48 (SD = .76).

Need for faculty development opportunities

A large proportion of professors (93%) indicated they were interested in continuing their education, and 87% believed that they needed another academic degree. They also indicated on a 1-5 scale that the most important reasons for continuing their education were that they wanted to learn more about their subject area (M = 4.6, SD = .58), keep up with new information (M = 4.5, SD = .63), and to be better at teaching (M = 4.4, SD = .74)). The

reasons with lower scores were: personal satisfaction (M=3.9, SD = 1.04), salary increases (M=3.6, SD = 1.10) and accumulate credits toward another degree (M=3.6, SD = 1.29). The most commonly mentioned barrier to continuing education was financial resources (40%) and time (27%). There were 144 mentions of subject areas in which professors would like to continue their education. Biology (25%), agronomy (22%), natural resources (19%) and social sciences (15%) were important areas for professional development.

Technical infrastructure and support systems available

When asked about technical infrastructure and support systems available to professors, 44% indicated they had formal training in computer use within the last year. Only 11% had never had formal training in this area. This should be considered in light of the fact that 40% of professors indicated they did not receive formal instruction to learn the software they already know how to use (self-directed learners).

Most of the professors (69%) indicated that they had sufficient access to a computer at work. However, many (58%) indicated they would like to have more access to a computer at work. A large proportion (72%) had access to a computer at home. Most professors (73%) indicated that they were able to socialize with people to share knowledge about computers or to ask about troubleshooting. Professors indicated a desire for more access to technical support (65%), software programs (58%), computers (51%) and e-mail (43%). Most of the comments regarding availability of equipment, software, and communications emphasized that poor circumstances were prevalent. Most of the professors (63%) had an Internet e-mail account, and 52% used the account at least once a week.

Predictors of adoption (3 models)

For model 1, the dependent variable was adoption of computers and the Internet in classroom instruction. The magnitude of the relationships between adoption and the 29 independent variables in the model were calculated. It was found that eleven variables had statistically significant correlations with the dependent variable. The magnitude of these eleven correlations were from low to moderate. The strongest correlations (moderate) were found between adoption and self-efficacy levels ($r = .34$), and use of the Internet account ($r = .33$). The nine remaining variables had low correlations (between .10 and .29) and included: professors' (1) use of more than one computer application, (2) use of at least one Internet application, (3) having an Internet account, (4) having had recent formal training, (5) being able to socialize knowledge about computers, (6) wanting more access to software, (7) planning more computer use in courses, (8) having institutional access to computers and telecommunications, and (9) holding the bachelor's degree. The stepwise multiple linear regression analysis with this set of variables resulted in the ability to explain 18% of the variability in adoption of computers and the Internet in classroom instruction. The explanatory model included the following predictor variables (1) self-efficacy scores, (2) being able to socialize knowledge about computers, (3) use of the Internet account, and (4) professors' planning more computer use in courses.

For model 2, the dependent variable was potential adoption of distance education for learning. The magnitude of the relationships between potential adoption and the 36 independent variables in the model were calculated. It was found that sixteen variables had statistically significant correlations with this dependent variable. The magnitude of these

sixteen correlations ranged from low to moderate. The strongest (moderate) correlation was negative between potential adoption and professors' being computer self-learners ($r = -.31$). The fifteen remaining variables had low correlations (between .10 and .29) and included: professors' (1) use of more than one computer application, (2) use of at least one Internet application, (3) years teaching, (4) interest in continuing professional education, (5) subject matter being biology, (6) subject matter being veterinary, (7) interest in computer learning, (8) computer self-efficacy score, (9) choice of using distance education for learning via Internet, and (10) via video; professors (11) wishing more access to e-mail, (12) using an Internet account, (13) holding bachelor's degree as the maximum level of education, (14) having an Internet account, and (15) having access to computers at work.

The discriminant analysis indicated that five characteristics of professors could predict potential adoption of distance education for learning. The discriminant function resulted in a classification rate of 77%. Faculty who were considered potential adopters of teaching at a distance tended to be members of the group whose (1) maximum level of education was bachelor's degree, and tended to be members of the group whose (2) subject matter discipline was best described as veterinary. Potential adopters of distance education for learning (3) were more likely to choose distance education for learning via the Internet, and more likely (4) have been teaching at the CUCBA for more years than those who are not potential adopters. Also, those professors who reported (5) not needing formal instruction to learn about computers were less likely to be potential adopters.

For model 3, the dependent variable was potential adoption of teaching at a distance. The magnitude of the relationship between potential adoption and the 37 independent

variables in the model were calculated. It was found that ten variables had statistically significant correlations with the dependent variable. Five correlations were at the moderate level including: (1) whether professors considered distance education an option for their own education (r = .41), (2) whether they would use distance education if available (r = .40), (3) whether they would choose the Internet as a medium for distance education (r = .37), (4) whether they were computer self-learners (r = -.36), and (5) whether they would choose satellite as a medium for distance education learning (r = .30).

The discriminant analysis indicated that seven characteristics in this model could predict adoption. The discriminant function resulted in a classification rate of 81%. Results showed that potential adopters of teaching at a distance were more likely to (1) consider distance education as an option for their own learning, and would more likely (2) choose distance education for learning via satellite, as well as (3) the Internet. They were also more likely to (4) be able to have contact with people with whom they could share experiences and knowledge about computers, or ask about troubleshooting (socialize knowledge) computer problems. Potential adopters were more likely to (5) consider restructuring their courses to incorporate more use of computers. Potential adopters were also less likely to (6) have sociology as their subject matter discipline, and were less likely to (7) be computer self-learners.

Discussion

This study investigated the extent to which personal and institutional characteristics of professors in the College of Agriculture in Guadalajara were related to the use of computers

for traditional teaching and for distance learning and teaching. The findings served as the basis for conclusions applicable only to all professors at the College of Agriculture in the University of Guadalajara in Mexico.

The analysis of variables suggests that practically all of the professors utilize computers for their own professional activities, and half of them use the Internet. The characteristics of professors as they relate to the utilization of these technologies in academic activities, and their desire for further utilization are discussed in the following sections.

Interests in the use of computers for traditional and distance teaching

Results of this study indicate that professors were highly interested in the use of computers and their applications in traditional and distance teaching. High levels of interest in computing technologies have consistently been found among agricultural educators (Nordheim & Connors, 1997, Murphy & Terry 1994) and educators in other disciplines (Delcourt & Kinzie, 1993). If professors are interested in the use of computers for teaching, then why is it that 41% of professors have never used computers in the classroom? And, why have 85% of professors never used e-mail to deliver class materials, or to communicate with students? The use of electronic technology in teaching has been explained to be an outcome that depends on a combination of several factors (Beal, 1981; Birkenholz, 1992; Nordheim & Connors, 1997; Pugalee & Robinson, 1998). Interests, utility beliefs, attitudes, skills, training, and access are some factors that should be considered in combination. For example, Pugalee and Robinson (1998) found that training in using Internet resources for mathematics and science graduate education students was effective in changing their skill in using the Internet

and their skill in designing lessons and applications using the Internet. Training in using the Internet was effective also in changing teachers' attitudes toward the Internet as an educational resource.

It was found that professors in Guadalajara perceived computers to be useful in their teaching. Professors were aware that the use of electronic technologies can contribute to improving students' skills, and a significant proportion of professors (82%) were planning to incorporate more use of technology in teaching. These are examples of the presence of utility beliefs among professors, which has been found to be a significant predictor in deciding the desirability of learning computer skills (Zhang & Espinoza, 1998). On the other hand, professors felt they needed more training so they could incorporate technology in teaching, which is a common concern among agriculture educators (Nordheim & Connors, 1997). Professors also showed their frustration with the low access to equipment. They consistently indicated that the equipment and software available were too old and much of the equipment could not be connected to the Internet.

Some professors manifested their skepticism about the effectiveness of distance education programs. They questioned the use of technology in teaching, and manifested their belief that there is no substitute for face-to-face communication with students. This discussion of skepticism regarding effectiveness of education at a distance, versus the opportunities that distance education provides, is a frequently visited topic in the literature, and probably will continue to be so in the near future.

With regard to teaching at a distance, only half the professors showed interest. This might be interpreted as low when compared to 70% of professors of agriculture in the U.S.A.

(Nti & Bowen, 1998) who were interested. However, this number should be seen in the context that teaching at a distance is not a common practice in this university. The typical idea of distance education among U of G professors has been predominantly as consumers (receivers of courses), and not as producers. Having half of the population as potential adopters of teaching at a distance is then interpreted as a good proportion. Bowen and Thompson (1995b) reported that department heads at land-grant universities in the U.S.A. perceived that faculty need in-service education in order to teach distance education courses effectively. This statement might be applicable to faculty in Mexico as well.

Attitudes toward the use of computers for traditional teaching and for distance learning and teaching

Terminology used in the literature to address constructs from the affective domain vary. This variance makes it difficult to compare results among research findings. Examples of different terms are *interest* (Miura, 1987; Nti,& Bowen, 1998), *importance* (Murphy & Terry, 1995a; Nordheim & Connors, 1997), and *feelings* and *perception* (Delcourt & Kinzie, 1993). In this study, the affective domain was represented by interests and attitudes.

The data collected suggested that most professors held positive attitudes toward the use of computers for traditional teaching and for distance learning and teaching. Also, professors believed that computer technology can bring benefits to their teaching. This finding is consistent with previous research findings among agriculture professors in the U.S.A. (Murphy & Terry, 1995b; Nordheim & Connors, 1997). This intuitive notion of the benefit of the use of technology in instruction has found support in several studies. Day, Raven, and

Newman (1997) found that students who used information technologies reached higher levels of achievement when compared with students who used the traditional classroom approach. Liao (1998) did a meta-analysis of thirty-five studies to compare the effects of hypermedia and traditional instruction on student's achievement. He found that the use of hypermedia in instruction resulted in more positive outcomes when compared to the effects of traditional instruction.

With regard to attitudes toward distance education, a majority of professors (60%) consider distance education as an option for their own education, and they would take courses at a distance if available (77%). However there still exists a lack of confidence in this form of education which has also been found among agriculture educators in the U.S.A. (Miller & Shih, 1997). One possible explanation for the current acceptance of distance education systems in the Mexican audience is the high percentage of professors who had already used alternative media for learning (77%), and their willingness to use it again (79%).

Self-efficacy levels in the use of computers for traditional teaching and for distance learning and teaching

Professors felt confident communicating with computer technology (using electronic mail), and as consumers of information (retrieving information over the Internet). However they did not feel confident disseminating information (creating web-sites), nor did they feel confident taking active roles in list-serves and chat rooms. Perhaps providing training in these areas would help professors to play active roles and use the Internet more as an educational tool (Pugalee & Robinson, 1998).

Scores for the adoption of computers and the Internet in classroom instruction tended to increase as the score of computer self-efficacy increased, with a moderate correlation (.34). In fact, self-efficacy was the variable which had the highest correlation with the adoption of computer use in Model 1 (Figure 4.1). This correlation is similar to that found by Faseyitan and Hirschbuhl (1992) (.32) between self-efficacy and adoption of computer use by university instructors. In the regression analysis, self-efficacy was one of the predictors (out of four) that explained 18% of the total observed variability in adoption of computers for instruction.

This finding is supported by previous research which reported that *ability* plays an important role in *self-efficacy*. Self-efficacy plays a role in *goal-setting*, and both (goal-setting and self-efficacy) have an effect on *performance* (Phillips & Gully, 1997). Since adults are more likely to be intrinsically motivated (Bandura, 1986), resources to enhance self-efficacy levels would be better directed toward efforts in training (Faseyitan et al., 1996) and availability of support systems, with less emphasis on personal rewards. An effective way to distribute incentives was reported by Faseyitan et al. (1996). In their program, the incentive was provided by funding the purchase of hardware and software after professors participated in training activities.

Computer self-efficacy was not in the group of variables selected in the discriminant analysis procedures as a predictor of adoption of distance education for learning (Model 2), nor was it in the group of variables predicting distance education for teaching (Model 3). In general, there seems to be a lack of connection between computer self-efficacy and preference for distance education technologies. This might be explained by the fact that past experiences of this audience with distance education activities have been mostly via satellite

with little use of computer mediation. However, when professors were asked which media they would prefer for distance education learning, the Internet was more desired than satellite.

Current use of computers and electronic communications for teaching

The proportion of professors who reported they were planning to restructure courses to increase the use computers was high (82%), when compared to what Faseyitan and Hirschbuhl found among professors in state universities in Ohio (45%) in 1992. This might be because of the importance of the use of computers in education has grown increasingly over time.

The number of professors using computers and electronic communications for teaching is generally low. The most intensive use of computers by professors was in class preparation (89%) which was defined by Osborne (1992) as *managing* instruction. Similar findings of high use of computers for managing and low use for teaching were reported by Nordheim and Connors (1997), and Adam and Wilson (1996). These researchers recommended more hands-on inservice educational programs so teachers and students could stay on the cutting edge of computer technology. Some professors might take the courses, and then a "bandwagon effect" may cause others to follow.

There appears to be a discrepancy in data between *availability* and *use* of computers. While professors reported low access to computers in the work environment, they reported high use in class preparation and professional use. This might be explained by the fact that 72% of professors in the College of Agriculture in Guadalajara reported having access to a computer at home. Maybe the limited access to computers at work is a factor that prompts professors to purchase their own equipment to use at their leisure at home.

The finding that professors at the University of Guadalajara perceived their access to computer technologies at work to be limited is consistent with other research reports (Murphy & Terry, 1995a; Pugalee & Robinson, 1998). However, Adam and Wilson (1996) found that even when Australian educators had access, and adopted information technology earlier than the broader community, it was evident that they were not planning to use these technologies in the future in their teaching. It would be interesting to study future trends, after adoption, in this Mexican community. However, one should be cautious and consider that access should be a precondition to adoption for professional use, and only after this, adoption in actual teaching could be measured.

The same precondition of access could be applied to students' adoption of computers. Most professors (78%) had asked students to do homework using computers, which is high when compared to the 39% found by Faseyitan and Hirschbuhl in 1992. However, professors indicated that they hesitate asking students to use computers because access to equipment in the university is limited and most of the students do not have computers at home.

Only half of the respondents (52%) were users of an Internet account. Even though this proportion may seem high, it raises the question: What is it that is preventing professors who are non-users from adoption? There are still one third of the professors who do not even have an Internet account. Their degree of innovativeness puts them in the categories of late majority and laggards. Laggards are the last in a social system to adopt an innovation and possess almost no opinion leadership (Rogers, 1995). It was found that as the years of service of a professor increased, the less likely it was that the professor will use an Internet account. This same trend was found by Faseyitan et al. (1996) among college professors in the United

States. They suggested that lack of use of computer technologies in the classroom can be improved substantially by providing training, and improving availability, so that experienced professors will be in a better position to take advantage of modern technology and close this gap.

Need for support for faculty development opportunities in subject matter, teaching methods and degree seeking

College of Agriculture administrators reported the need for improving the level of education held by professors. However it was important to identify what the professors thought themselves about their level of education. Did professors think they needed to improve their level of education? Since 15% of professors already held a Ph.D. degree, the rest of the professors were expected to consider themselves as needing an additional academic degree. This expectation was met with 86% of professors considering themselves as needing an additional academic degree. They also manifested great interest in continuing their professional education (90%). These proportions in the levels of education are similar to those reported by Macías-López (1990) among respondents in thirty agricultural education institutions in Latin America, though he mentioned that the minimal requirement for teaching undergraduate courses varies notably among institutions. In the College of Agriculture in Guadalajara, professors' needs for further education are more pressing every day due to new policies implemented by the administration. Professors with higher degrees hold leadership positions and better salaries than their colleagues with lower academic degrees. That is why it is not surprising that those professors lacking the doctorate degree very likely will be interested in, and hold positive attitudes toward, alternative methods of increasing their educational level.

The information reported by professors about their level of education differs somewhat from that reported by the administration. Reports of holding a Master's degree came from 58% of the respondents, while the administration reported only 38%. Reports of holding a Bachelor's degree came from 27% of the respondents, when the administration reported 46%. Regarding the Ph.D. level there is not much discrepancy since 15% of professors reported holding this degree, and the administration reported 16%. These differences may be due to the fact that some professors were graduate students who may have been close to finishing all the academic requirements for a degree. Sometimes professors regard themselves as having the degree but the administration does not see things this way, which may explain the difference.

Throughout the questionnaire professors indicated a positive attitude towards training as a need and precondition for the use of computers in the classroom and their professional life. Training is consistently mentioned as a recommendation based on research findings (Faseyitan & Hirschbuhl, 1992; Faseyitan, Libii & Hirschbuhl, 1996; Murphy & Terry, 1995a; Nordheim & Connors, 1997; Nti & Bowen, 1998). Bowen and Thompson (1995b) mentioned that some American universities with distance education programs were already exploring the option of offering the Master's degree via distance education to meet Extension professionals' training needs in the U.S.A. These programs, they mentioned, could also be delivered to other countries, at least theoretically.

The most common reason volunteered by professors for not pursuing further education was lack of financial resources. This is deeply interwoven with (1) time availability, (2) work load, and (3) other engagements, inasmuch as professors need to make choices in their use of time based on their financial needs and support systems. These findings are in

agreement with what Scanlan and Darkenwald (1984) found among U.S.A. health professional adult learners in their identification of deterrents to participation in continuing education. From this, it can be assumed that adults share common concerns across these two audiences with different cultures and from different countries.

Proficiency in English in this community remains a limiting factor when discussing the potential for academic growth at the international level. Even at the national level, there are graduate programs in Mexico that require specific TOEFL scores. For a professor in the College of Agriculture, knowing only one language, Spanish, limits his/her possibilities of academic growth to graduate programs taught in Spanish.

Proficiency in English is also an issue with regard to computer and information technology use. Even when professors could communicate via the Internet with other colleagues in the world, their universe is limited to those people speaking Spanish. Retrieving information from the World Wide Web presents the same limitation. Also, if a professor does not have English skills, his/her use of software is limited to the versions written in Spanish.

A small proportion of respondents (16%) reported that they had taken the TOEFL test. It was further found that of the 26 respondents that had taken the test, 21 already held the master's degree or higher. This may indicate that those who most needed an extra academic degree, are less likely to meet the English requirements.

Perceptions of the technical infrastructure and support systems available to faculty

The lack of available formal computer training was evident. Half of the professors reported that the last training in computers that they had received was more than one year ago.

This is important, especially in light of the fact that 60% indicated they needed formal training in order to use the computer applications they were using. In a related vein, 73% of professors reported having communication with peers to discuss computer troubleshooting. Informal support systems may not be sufficient for meeting professors' needs. Indeed, the availability of a formal technical support system was indicated as needed by 65% of the professors.

As stated before, professors generally have positive attitudes toward the incorporation of technology in teaching. However, they encounter problems such as limited access, low quality of equipment and software, and the need for training. Nordheim and Connors (1997) found similar attitudes among educators in agricultural education programs in Washington, Oregon and Idaho, even though the educators in the Northwest utilize modern up-to-date computer hardware and software.

Even when access to computers by professors in the work place was reported as sufficient (70%), most professors have to share a computer with two or more people. Only 11% reported having a computer for their own use. Even more, one professor reported having to bring his/her own computer to use in the workplace. While 38% of respondents reported having all the access to a computer that they need, 58% reported they would like more. This indicates the likelihood that these professors would use technological resources more intensely if they were available. This situation also may be an explanation for the unexpected finding that 72% of professors reported having access to a computer at home.

These findings are similar to previous research reports. Murphy and Terry (1995b) found that technical infrastructure and support systems are common concerns in agricultural education settings. They outlined four areas for improvement that would enhance the use of technologies

and may apply to this Mexican audience as well: (1) an increase in the availability of educational opportunities for students, 2) improved informational resources for faculty and students, 3) more effective instructional materials, and 4) more convenient delivery methods for instructors.

Predictors of adoption

Model 1

Out of the twenty-nine variables in this model only four accounted for 18% of the variability in the scale related to the adoption of computers and use of the Internet in traditional teaching. These variables were: (1) computer self-efficacy score, (2) socialization of knowledge about computers, (3) use of an Internet account, and (4) planning to restructure courses for more computer use (Figure 5.1). Since this is an exploratory stage of research, the variables found in this model should be regarded as a starting point for future research. Further research can be enhanced with more focused instruments. However it is of interest to emphasize that self-efficacy was found as a predictor of adoption. Considering Bandura's (1986) argument it is plausible to suggest that those professors who perceived themselves self-efficacious are more likely to spend more effort and will be more perseverant in dealing with the specific task, in this case, the use of computers. Bandura proposed that self-knowledge about one's efficacy is based on (1) authentic mastery experiences, (2) observing the performance of others, (3) verbal persuasion and allied types of social influences which indicate that one possesses certain capabilities, and (4) physiological states from which people partly judge their capability, strength, and vulnerability to dysfunction. In light of our finding of self-efficacy as a predictor of adoption, and if we accept Bandura's argument as an

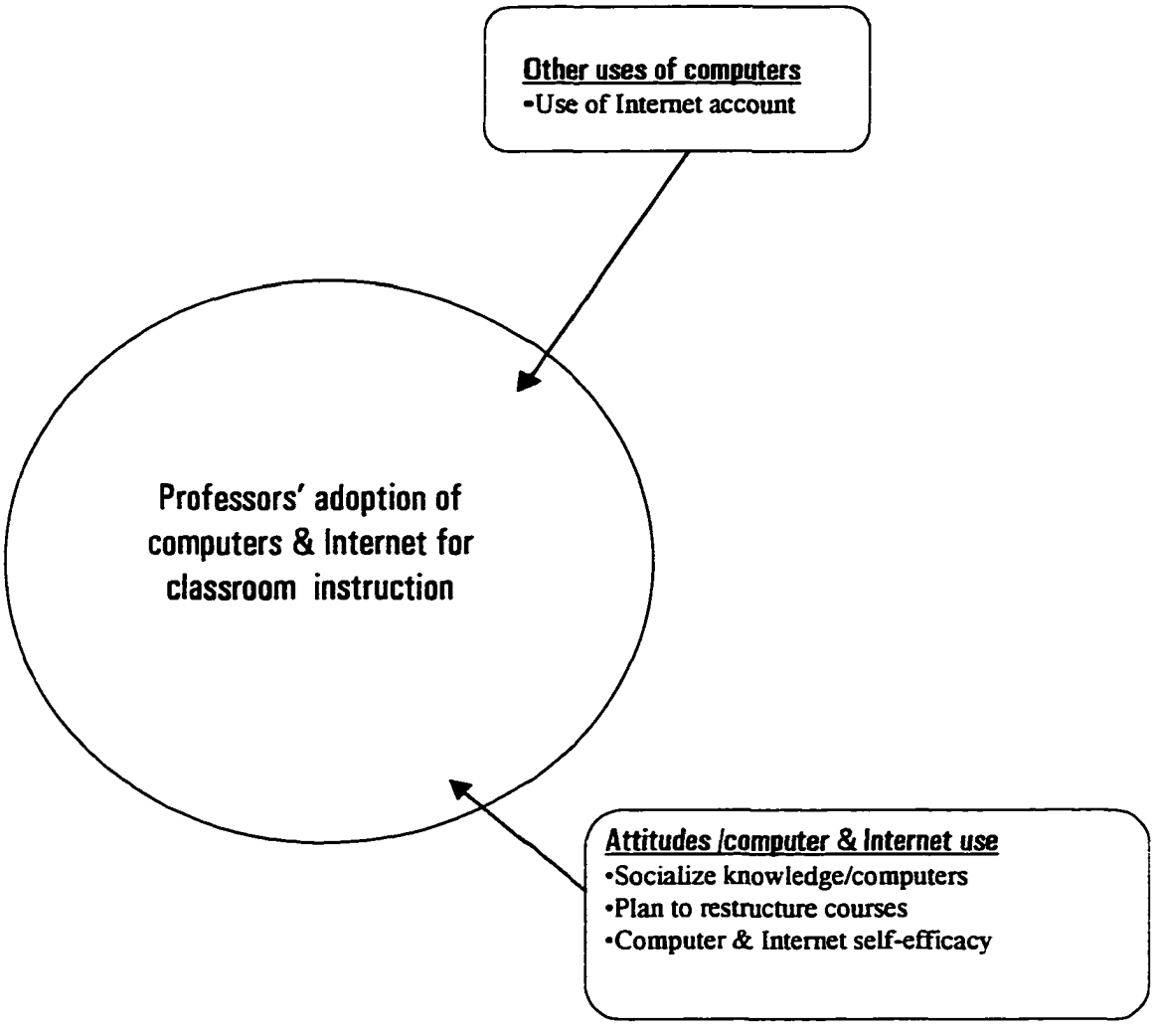

Figure 5.1 Model 1. Variables that explain 18% of the variability of professors' adoption of computers and the Internet for classroom instruction.

explanation of self-efficacy, then the four items listed above can be instrumental in explaining adoption, along with the other three predictors.

Model 2

Communication technologies present new educational opportunities, particularly to non-traditional audiences, by improving access at a distance. However, it would be erroneous to assume that everyone will find these opportunities to fit their educational needs. Indeed, only 78% of department heads in American universities were reported to be supportive of their department's faculty downlinking courses (Bowen & Thompson, 1995b).

In the College of Agriculture in Guadalajara, only 60% of professors considered distance education to be an option for their own education. These constituted the group of potential adopters of distance education for learning. But, what is it that makes them distinct from the rest of the population? With the use of the discriminant analysis five characteristics were identified as predictors of potential adoption. These are presented graphically in Figure 5.2. and discussed here.

Among these five predictive variables, two were professors' personal attributes. The fact that professors holding a Bachelor's degree as the maximum level of education is a predictor may be explained by considering that members of this group are in a greater need for further education than other educational level groups, particularly education that leads toward getting a graduate degree. To meet this need the Mexican universities are already developing programs at a distance (U de G, 1996). Bowen and Thompson (1995b) reported finding the same need among Extension agents and secondary teachers for which there were already

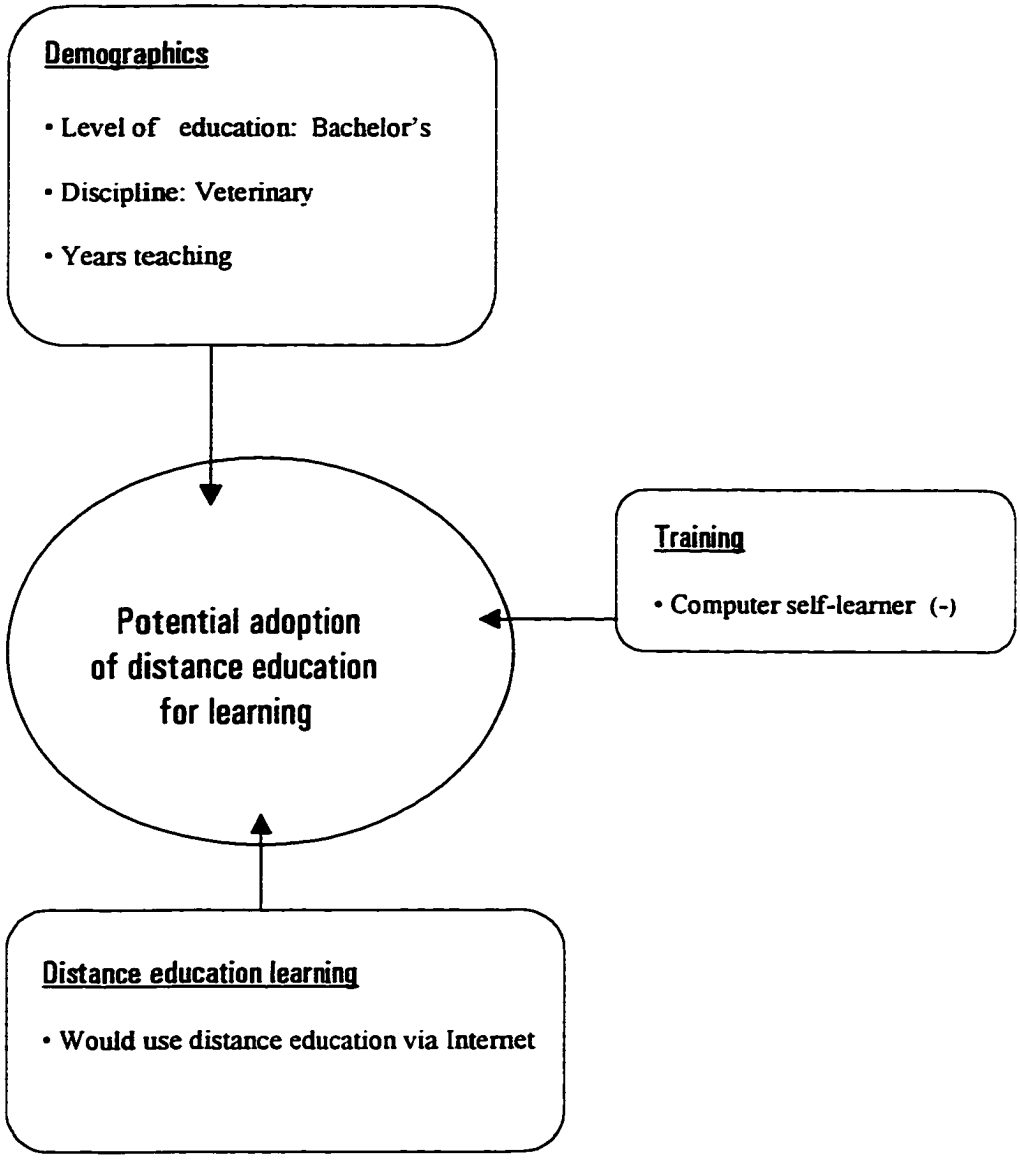

Figure 5.2 Model 2. The most distinguishing characteristics to predict professors' potential adoption of distance education for learning.

Master's programs in American universities targeting this need. The second personal characteristic that was a predictor refers to the subject matter discipline. Professors whose discipline was veterinary were more likely to be potential adopters of distance education for learning. This information is of practical use for recruiting purposes in future training programs. Professors whose subject matter is not veterinary may need different approaches for recruiting. This result is supported by previous research findings (Faseyitan & Hirschbuhl, 1992). Faseyitan and Hirschbuhl (1992) explained that professors from disciplines with quantitative or technological orientation were more likely to adopt computers than their counterparts. This phenomenon is associated with the complexity of the innovation. When the adopter needs to develop new skills and understandings, the innovation will be adopted more slowly than simpler innovations (Rogers, 1995).

Another predictor was in the area of training. Professors who did not need formal training to use computers were less likely to be potential adopters of distance education for learning. This negative correlation with the dependent variable to predict potential adoption may indicate that when professors think of distance education, the medium of delivery is not necessarily computer-based. Perhaps the reason for this is that education via satellite already had a strong presence among this audience, as it is in American universities (Dodrill, 1995). Fortifying the use of computers by raising the self-efficacy levels (Faseyitan & Hirschbuhl, 1992) might influence adoption of Internet-based distance education programs. Raising self-efficacy levels might also be helpful to professors with more years of in-service who were also found to be more likely to be potential adopters of learning at a distance and could also support those choosing the Internet for learning at a distance.

Model 3

Half of the professors were interested in teaching at a distance. This proportion may seem low when compared to the 70% reported among U.S.A. agricultural educators (Nti & Bowen, 1998). However, half of the population is still a good number that should be taken into account when considering availability of instructors in distance education program planning (state, national or international programs).

With regard to characteristics of professors that are interested in teaching at a distance, Nti and Bowen (1998), found that professors with distance education skills and tenure were more likely to be interested in delivering courses by distance education. However, they did not specify which distance education skills. In the discriminant analysis with the population in Guadalajara, the only characteristic that was found as a predictor that was related to skills is related to computer use (Figure 5.3) and does not support Nti & Bowen's finding. Professors who did not need formal training prior to using computers (computer savvy) were less likely to be potential adopters of teaching at a distance. This may imply that those interested in teaching at a distance were not necessarily heavy computer users. It may also indicate the need for specific efforts in computer training as a precondition for adoption of computer-based distance teaching.

Due to the exploratory stage of this research in the College of Agriculture in Guadalajara, caution should be exercised in interpreting the results of this model. There were two predictors of adoption that were positively related to the use of computers. Professors who had the opportunity to socialize knowledge about computers, and professors planning to restructure courses for more use of computers were more likely to be potential adopters of

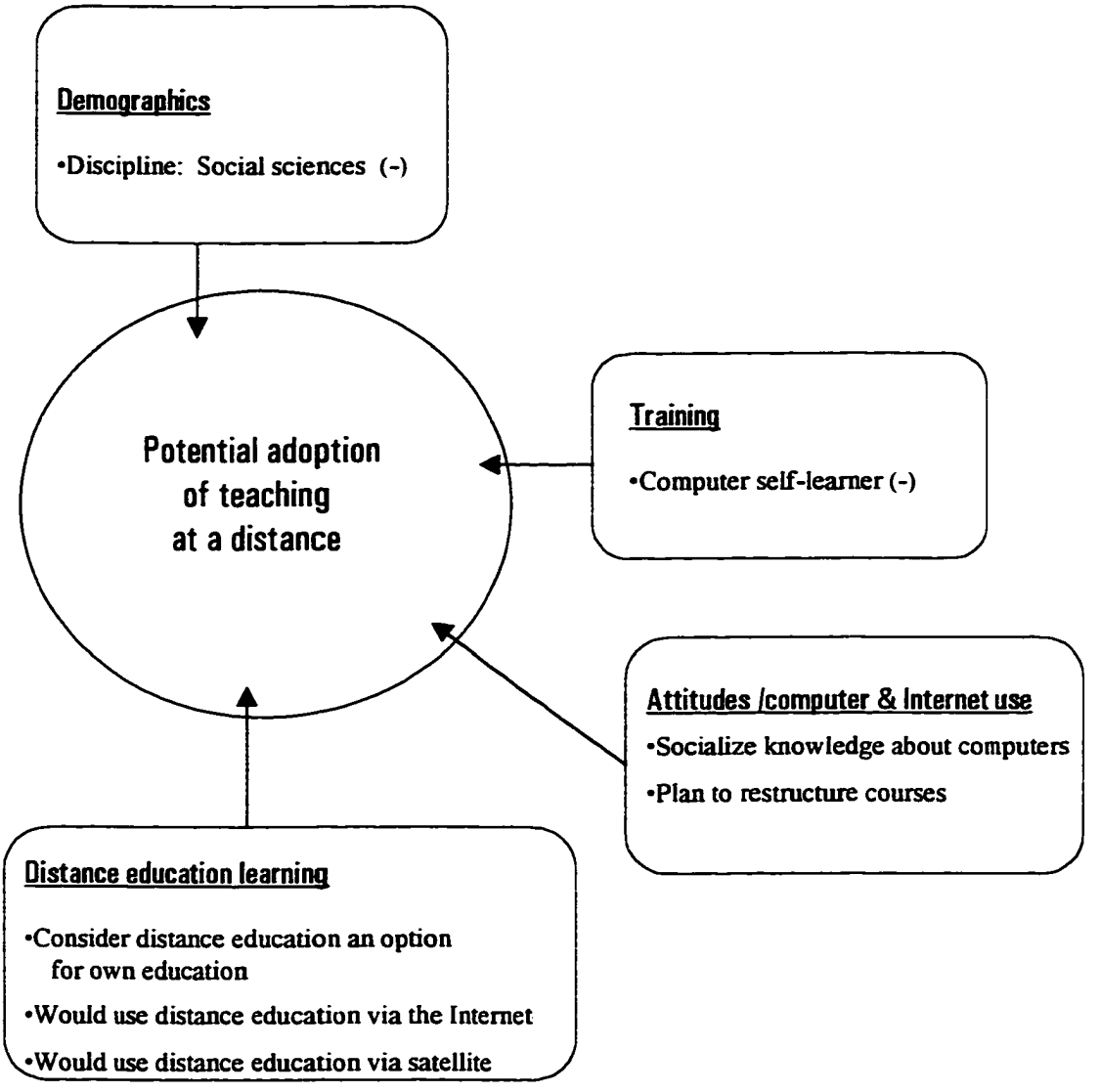

Figure 5.3 Model 3. The most distinguishing characteristics to predict professors' potential adoption of teaching at a distance.

distance teaching. These findings are encouraging for computer-based projects since they indicate that there might be a pool of professors willing to try computers as the medium for teaching.

Professors considering distance education an option for their own education being a predictor of potential adoption of teaching may seem natural. However professors may be aware that teaching at a distance requires more planning and team work than is needed in traditional teaching.

Another predictor of professors' potential adoption of teaching at a distance was whether social sciences was their discipline. It is interesting to note that professors in the social sciences consistently issued negative comments about distance education and the use of technology in teaching. Social sciences are not considered to be a technical discipline, and in the questionnaire it was evident that distance education has been associated with computer use. Faseyitan and Hirschbuhl (1992) found that a predictor of adoption of computer use was the technological orientation of the faculty members' discipline. They explain that faculty whose disciplines are not quantitative or technological in orientation require more cognitive effort in order to use computers. This may explain the attitudes of professors in social sciences.

Another predictor of professors' potential adoption of teaching at a distance was the preference for the use of satellite for distance education learning. Previous experience of satellite use for distance education activities might explain this preference (Bandura, 1986). Whether professors would choose the Internet for learning is another predictor. This was surprising. It is very unlikely that professors have had the opportunity to observe computer-

based experiences of distance education delivered via the Internet. Pisanty (1998) hypothesized that the Mexican community, due to cultural factors, would choose more face-to-face communications in distance education, such as interactive video, though he suggested that quantitative research was needed to support his hypothesis. The findings in the present research show that cultural factors might not explain the use or non-use of computer-based interactive technologies.

Conclusions

1. College of Agriculture professors in Guadalajara were interested in improving their skills in the use of computers and the Internet and in the use of computers in traditional teaching.
2. Professors held a positive attitude toward the use of technology in educational activities, believed that the use of electronic technologies improved their teaching, and believed that technology would prepare students better for their professional careers. It was also concluded that professors desired more access to up-to-date equipment, and they desired more access to telecommunications.
3. Based on the computer and the Internet self-efficacy scores it was concluded that professors felt confident communicating with computer technology (using electronic mail), and in consuming information (retrieving information over the Internet). However they did not feel confident disseminating information (creating web-sites), nor did they feel confident taking active roles in list-serves and chat rooms.

4. In the College of Agriculture in Guadalajara computers were commonly used for managing instruction, but were rarely used for actual teaching. The limited access to information technology in this College of Agriculture was regarded as a barrier for increased use of the resources available on the Internet.
5. Professors in the College of Agriculture perceived the computer technical infrastructure available was insufficient both in equipment and access to telecommunications. Besides that, the lack of a formal technical support system was identified as a limiting factor to taking advantage of the information technology.
6. Skills in the use of English as a second language may be a deterrent to further academic growth and adoption of computers. Those in greater need of furthering their education (professors with a Bachelor's degree as the maximum level of education) were in greatest need for improving their English skills.
7. Professors were highly interested in having more opportunities available to meet their educational needs. Training programs addressing subject matter, teaching methods, and degree seeking should be well accepted by this professional group.
8. Distance education programs would be welcomed by at least sixty percent of the professors for their professional development.
9. Professors were highly interested in the use of Internet-based distance education opportunities.
10. There is a large number of professors in the College of Agriculture interested in delivering courses at a distance. The administration could potentially plan courses at a

distance considering that availability of instructors would not be the limiting factor, though training issues should be considered.

11. Computer self-efficacy scores, socializing knowledge about computers, frequent use of the Internet, and planning for more use of computers in the classroom, explained a significant proportion of the variance in adoption of computer technology in the classroom.

12. Professors who were considered potential adopters of distance education for learning tended to be members of the group holding a bachelor's degree as the maximum level of education. These professors also tended to be members of the veterinary medicine discipline, and more likely to have more years teaching at CUCBA. Potential adopters tended not to be computer self-learners, and more likely would choose distance education via the Internet.

13. Professors who were considered potential adopters of teaching at a distance tended not to be members of the social sciences discipline, and tended not to be computer self-learners. Potential adopters were more likely to socialize knowledge about computers, tended to plan to restructure courses to use computers in the classroom more than previously, tended to consider distance education an option for their own learning, and more likely would choose distance education for learning via the Internet, and via satellite.

Recommendations

1. Findings of this study should be made public among the professors in the College of Agriculture in Guadalajara, as the initial part of a program to promote integration of technology in teaching and learning.
2. The level of awareness about the use of computer technology in the classroom found among professors indicates that there is no need to invest resources in order to get professors more interested in the use of computers in traditional on-campus teaching. Bypassing the awareness stage would save time and resources in the adoption diffusion process.
3. Programs should be developed to increase professors' ability to use computers. These programs might increase professors' self-efficacy levels and, as a consequence, professors would set higher goals that require the use of computer skills in academic activities. Showcases or exhibits, seminars, and workshops should be part of the strategy.
4. Professors perceived the access to equipment and telecommunications at work to be limited. In order to reduce these constraints, the University could provide full Internet access for professors who have computers at home. This would be most important for those professors whose courses include the use of computers and telecommunications.
5. Data indicated that there is room for improvement in the area of professors' English skills. In-service training in English would contribute positively to training efforts directed to other areas such as computer use and academic development.

6. If there is interest in promoting Web-based distance education programs, the adoption-diffusion process should include a well implemented awareness program that emphasizes the advantages of education at a distance based on the Internet. This recommendation is based on the lack of connection between computer use and acceptance of education and teaching at a distance.
7. Since half of the professors showed interest in teaching at a distance, administrators in the College of Agriculture in Guadalajara should consider this as an asset in future planning. Administrators should encourage professors interested in this form of course delivery by providing opportunities to deliver courses at a distance.
8. In the attempt to enhance adoption of computer technology in the classroom, it is recommended that the administration sponsor special programs to strengthen: (1) professors socializing knowledge about computers, (2) frequent use of the Internet, (3) planning for more use of computers in the classroom, and (4) computer self-efficacy levels.
9. This study generated a list of software packages that professors indicated they would like to learn to use. This list should be considered before delivering training programs.

Recommendations for Further Research

1. This study should be replicated to analyze other professional populations in the University of Guadalajara, or at other universities in Mexico.

2. Since this study was considered exploratory, the three models used in this study may provide a useful foundation in designing better models and more precise measures in the statistical procedures.
3. The models used to determine adoption of computers in the classroom, and potential adoption of distance education for teaching and learning, might have been too simple in this exploratory stage of research. In further research, it is recommended that path analysis be used to analyze the more complex relationships that could exist among the variables entered in the three models.
4. A follow-up study is recommended to answer other questions such as: (1) Once professors in this College get better access to equipment and communication, will they use technology in their actual teaching for traditional on-campus courses? (2) Will professors eventually adopt computer technologies for educational activities at a distance for professional development and teaching at a distance?
5. The University of Guadalajara has shown interest in the practice of distance education. Professors in the College of Agriculture seem to be ready to use this form of education, particularly on computer-mediated education. Further research is recommended to find out the means to use this technology effectively.
6. To be able to compare results among different studies, similar terms should be used to study constructs in the affective domain. An understanding of the terms with respect to a taxonomy is critical for advanced research. One particular problem identified in the literature was the variety of terms used as synonyms for *attitude*.

7. A large proportion of professors (60%) considered distance education as an option for their own education, and they would take courses at a distance if available (77%). However, this also indicates that there still exists a lack of confidence in this delivery mechanism. Further research should continue to study attitude change over time and under different levels of exposure to distance education experiences.

8. With regard to self-efficacy, future research should focus on explaining why professors do not feel confident taking active roles in the use of the Internet such as disseminating information (creating web-sites), or taking active roles in list-serves and chat rooms. Focusing research in this area might help to find the means for overcoming professors' lack of confidence in active participation, and in doing so, help professors to receive the maximum benefit from this technology.

APPENDIX A.
HUMAN SUBJECTS RESEARCH APPROVAL FORM

Last name of Principal Investigator Carr

Checklist for Attachments and Time Schedule

The following are attached (please check):

12. x■ Letter or written statement to subjects indicating clearly:
    a) the purpose of the research
    b) the use of any identifier codes (names, #'s), how they will be used, and when they will be removed (see item 17)
    c) an estimate of time needed for participation in the research
    d) if applicable, the location of the research activity
    e) how you will ensure confidentiality
    f) in a longitudinal study, when and how you will contact subjects later
    g) that participation is voluntary; nonparticipation will not affect evaluations of the subject

13. ■ Signed consent form (if applicable)

14. x■ Letter of approval for research from cooperating organizations or institutions (if applicable)
15. x■ Data-gathering instruments

16. Anticipated dates for contact with subjects:

First contact	**Last contact**
February 28/98	March 15/98
Month/Day/Year	Month/Day/Year

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:

December 31/98
Month/Day/Year

18. Signature of Departmental Executive Officer | Date | Department or Administrative Unit

[signature] | 2-2-98 | [illegible]

19. Decision of the University Human Subjects Review Committee:

X ■ Project approved ■ Project not approved ■ No action required

Patricia M. Keith | 2-9-98 | [signature]

Name of Committee Chairperson | Date | Signature of Committee Chairperson

GC 1/98

APPENDIX B.
COVER LETTER OF THE QUESTIONNAIRE IN ENGLISH

English version of the letter to the respondents in Spanish.
Stationary of the Universidad de Guadalajara was used.

March 1998

Dear professor:

Enclosed you will find a questionnaire we are asking you to answer. The objective of this survey is to estimate the integration of computer use and electronic communication technologies in course delivery. This will help in the development of a faculty development program tailored to your needs. This project is part of academic collaboration between Iowa State University and the University of Guadalajara.

You are free to participate, and this will take about 15 minutes.

The source of information will be kept strictly confidential.

Please complete and return the questionnaire.

Thanks for providing this valuable information that will contribute to the development of quality programs offered to faculty at CUCBA. If you have questions or want to learn more about this research, please contact the principal investigator Ana Ramirez Carr via e-mail: <aramirez@iastate.edu> or, you can get information about the situation of this research at http://www.public.iastate.edu/~aramirez/reporte.htm

Thanks

Ana Ramírez Carr
Iowa State University

M.C. Martín Tena Meza
Coordinator of Academic Services
Universidad de Guadalajara.

APPENDIX C.
COVER LETTER OF THE QUESTIONNAIRE IN SPANISH

UNIVERSIDAD DE GUADALAJARA

CENTRO UNIVERSITARIO DE CIENCIAS BIOLOGICAS Y AGROPECUARIAS

Marzo de 1998

Estimado Profesor:
Estimada Profesora:

Adjunto encontrará una encuesta para la cual solicitamos de favor su colaboración. El objetivo de la encuesta es estimar la integración de comunicaciones electrónicas y uso de computadoras en la enseñanza. Esto servirá para diseñar un plan de formación y actualización académica de acuerdo a lo que usted desea y necesita. Este proyecto es parte de la colaboración académica entre Iowa State University y la Universidad de Guadalajara.

Su participación es voluntaria, lo cual le tomará de quince a veinte minutos.

La fuente de información será manejada con estricta confidencialidad.

Por favor, complete y regrese la encuesta.

Gracias por participar. Con su información esperamos llegar a diseñar un programa apropiado para el CUCBA y nuestra época. Si usted tiene preguntas o si desea saber más acerca de esta investigación, por favor contacte a la investigadora responsable Ana Ramirez Carr vía correo electrónico: <aramirez@iastate.edu> o bien, puede encontrar información sobre el estado de esta investigación en Internet http://www.public.iastate.edu/~aramirez/reporte.htm

Gracias

Atentamente

Ana Ramirez Carr
Iowa State University

M.C. Martín Tena Meza
Coordinador de Servicios Académicos
Universidad de Guadalajara

Km. 15.5 Carretera Guadalajara - Nogales
Predio "Las Agujas", Nextipac, C.P. 45110 • AP 39-82
Tels (91-3) 682-0248 682-0374 Fax. 6820120
Zapopan, Jalisco, México

APPENDIX D.
QUESTIONNAIRE IN ENGLISH

1

Section 1 software you know or use

1. Please mark with an "✗" the boxes next to the computer applications you use on a regular basis. (mark all that apply).

	software:	examples:
☐	Word processor	WordPerfect, Word
☐	Electronic presentations	Power Point, Corel Presentations
☐	Statistical packages	SPSS, SAS
☐	Publishing	Page maker, Ventura
☐	Internet publishing	FrontPage, HoTMetaL
☐	Teaching over the Internet	TopClass, First Class
☐	E-mail client	Pegasus, Eudora
☐	Internet browsers	Netscape Communicator, Internet Explorer, AOL
☐	Others (specify):	

2. Are you interested in learning more about computer use?

☐ I am not interested

☐ I am fairly interested

☐ I am very interested

3. When was the most recent formal computer training/workshop or seminar you attended?

☐ Currently I am attending one.

☐ Within the last 6 months

☐ Within the last 7-12 months

☐ Within the last 1-2 years

☐ More than 2 years ago

☐ Never

4. *For the computer software packages you currently use, Did you receive formal instruction?*

☐ No

☐ Yes

5. Would you like to learn to use or improve your skills to use some software?

- ☐ No
- ☐ Yes

Which?

End of section 1

Section 2 access to computers and electronic communications

1. Do you have access to a computer at home?

- ☐ No
- ☐ Yes

2. If "yes" to the above question...
The number of users per computer is:

- ☐ 1-2 people / 1 computer
- ☐ 3 or more people/ 1 computer

3. At work, Do you have access to a computer?

- ☐ I don't
- ☐ It is insufficient
- ☐ It is about sufficient
- ☐ It is more than sufficient

4. At work how many people share one computer?

- ☐ Yourself only
- ☐ Yourself and one more person
- ☐ Yourself and other 2 to 4 people
- ☐ Yourself and more than 4 others
- ☐ You do not have access to a computer in your work area
- ☐ You use the Computation Center.

3

5. Please mark the statement(s)"☒" that best describe how you feel about computer access at work. (mark all that apply).

- ☐ At work I do have access to a computer but I don't use it.
- ☐ I do not need a computer to do my work.
- ☐ I have all the access to computers I need.
- ☐ At work I would like to have more access to a computer.

6. Do you have an Internet account (e-mail address)? (either at work or personal)

- ☐ No
- ☐ Yes

7. During the last four weeks, How often did you use your Internet account?

- ☐ Never
- ☐ Once
- ☐ Once a week
- ☐ At least 3 times each week
- ☐ I used it regularly
- ☐ Does not apply

8. Do you have contact with people with whom you can share your experiences and knowledge about computers, or ask about troubleshooting?

- ☐ No
- ☐ Yes

9. At work, you wish you had more access to: (mark all that apply)

☐ Computers ☐ W. W. W. ☐ More software programs

☐ Technical support ☐ E-mail ☐ Manuals

☐ Other (specify):

10. Optional comments: Please feel free to comment on your access and availability of computers and electronic communications at work.

End of section 2

4

Section 3 computer use and electronic communications in college teaching

Please mark with an "X" the number (only one) that best describes your situation:

During the last semester ... Frequency:	Did not teach	Never	Once	No Frequently	Frequently	Very frequently
1. When teaching, Did you use computers during the class periods? M=9	0	1	2	3	4	5
2. To prepare classes Did you use computers?	0	1	2	3	4	5
3. Did you ask your students to use computers to do homework?	0	1	2	3	4	5
4. Did you use E-mail to deliver class materials?	0	1	2	3	4	5
5. How often did you use fax to communicate with your students?	0	1	2	3	4	5
6. How often did you use e-mail to communicate with your students?	0	1	2	3	4	5
7. How often did you use telephone to communicate with your students?	0	1	2	3	4	5
8. How often did you use typed memos to communicate with your students?	0	1	2	3	4	5

9. Are you planning to restructure your courses and use computers more than previously?
   - ☐ No
   - ☐ Yes

10. Optional comments: Please feel free to comment on the use of computers and electronic communications in college teaching.

End of section 3

5

Sección 4 Knowledge and confidence to use computers and electronic communications

Below you will find a number of statements concerning how you feel about using computers. Please mark with an "X" the number (only one) that best describes how confident you feel.

My confidence level for performing this task is:				
Not confident 1	A little confident 2	Somewhat confident 3	Confi-dent 4	Most confident 5

Statement: When I need to ...	My confidence level for performing this task is...				
1. troubleshoot computer problems	1	2	3	4	5
2. install software programs	1	2	3	4	5
3. understand computer hardware terminology	1	2	3	4	5
4. understand computer software terminology	1	2	3	4	5
5. send e-mail (even user friendly software)	1	2	3	4	5
6. forward e-mail	1	2	3	4	5
7. edit text before forwarding E-mail	1	2	3	4	5
8. attach files to a message	1	2	3	4	5
9. create a mailing list	1	2	3	4	5
10. use a list-server and chat rooms	1	2	3	4	5
11. find specific information on the Internet	1	2	3	4	5
12. use search engines such as Yahoo	1	2	3	4	5
13. understand how the Internet works	1	2	3	4	5
14. explain how the Internet information is stored.	1	2	3	4	5
15. create a home-page	1	2	3	4	5
16. download files via Internet	1	2	3	4	5
17. explain how information is transmitted on the Internet	1	2	3	4	5

End of section 4

6

Section 5 how you regard technology for teaching and your readiness to continue your own education

1. Are you interested in further continue your professional education?

   ☐ No

   ☐ Somehow interested

   ☐ I am very interested

2. In the following statement you'll find some reasons for which you would continue your education. Please, for each reason, mark with an "✖" the number (only one) that best describes the level of importance for that reason.

If I were interested in continuing my education it would be because I want to ...	1 Not Important %	2 Little Important %	3 Important %	4 Very Important %	5 Extremely important %
Keep up with news in my subject area	1	2	3	4	5
Get personal satisfaction	1	2	3	4	5
Get credits toward a masters/doctorate degree	1	2	3	4	5
Be better at teaching	1	2	3	4	5
Learn more about my subject area	1	2	3	4	5
Get higher pay in my job	1	2	3	4	5
Other (specify):	1	2	3	4	5

3. Do you think you need an additional academic degree?

   ☐ No

   ☐ Yes

4. If you said "yes" to the above question ...
   Which is/are the subject area(s) you are interested in?

5. What do you think is (are) the major obstacle(s) to furthering your education?

7

6. Do you consider "distance education" as an option for your own education?

☐ No ☐ Yes ☐ I don't know what it means

Why?

7. In your experience as a student, did you received classes through the use of alternative media such as: (mark all that you have had experience with)

☐ Television ☐ Software or CD Rom

☐ Radio courses ☐ Internet

☐ Videocassettes ☐ Other: _____

8. If you marked some of the media above, according to your experience you feel like ...

☐ I will never consider these media as an option for teaching/learning again.

☐ I may consider these media as an option for teaching/learning again.

☐ Absolutely yes I will consider these media as an option for teaching/learning again.

9. Say you are interested in learning about a specific topic, and the only option would be available via distance education ... Would you take the course at a distance?

☐ No

☐ Yes

☐ Maybe

10. If your previous answer was "yes" would you be ready to take course via ... (mark all that apply)

☐ Correspondence (receiving printed materials that do not include electronic media)

☐ Internet (use of computers for communication that includes sound, video and immediate or non-immediate interaction)

☐ Satellite (live transmission of video and sound to a TV monitor, this can include live participation via telephone)

☐ Video (video combined with printed materials)

8

11. Do you think you are interested in teaching courses at a distance?

☐ No ☐ Yes ☐ I am not sure what this implies

12. Optional comments: Please feel free to comment on your believes regarding technology for teaching and the availability of opportunities for education.

End of section 5

Section 6 background information about yourself

1. Sex: ☐ Feminine ☐ Masculine
2. Age: ___ years
3. Educational level: ☐ Bachelors ☐ Masters ☐ Doctorate
4. Your ability to perform in English:
   - Reading ☐ _____ %
   - Writing ☐ _____ %
   - Listening ☐ _____ %
   - Speaking ☐ _____ %

   e) Have you ever taken the TOEFL? ☐ No ☐ Yes

   f) your TOEFL score is: _____
5. Undergraduate Major: _____
6. Category of appointment: ☐ Instructor ☐ Half-time ☐ Full-time
7. Years teaching at the CUCBA: _____ years
8. Your subject area discipline is best described as:
   - ☐ Agronomical Sciences.
   - ☐ Biological Sciences.
   - ☐ Math and Exact Sciences.
   - ☐ Vet Med
   - ☐ Social Sciences.
   - ☐ Other:

End of the questionnaire

APPENDIX E.
QUESTIONNAIRE IN SPANISH

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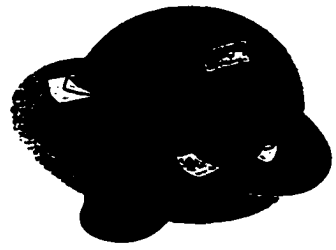
Cultivando el Futuro

CUCBA



cómputo y comunicaciones electrónicas como herramientas en la enseñanza - aprendizaje

¿Cómo andamos?

Universidad de Guadalajara
Centro Universitario de Ciencias Biológicas y Agropecuarias
Marzo 1998

Sección 1 software que usted conoce y/o usa

1. Por favor marque con una "X" los cuadros que corresponden a los programas/software que usted conoce y/o usa cotidianamente. (marque todos los que sean pertinentes).

Programas / software		ejemplos:
☐	Procesador de palabras	WordPerfect, Word
☐	Presentaciones electrónicas	Power Point, Corel Presentations
☐	Paquetes estadísticos	SPSS, SAS
☐	Publicaciones	Page maker, Ventura
☐	Publicar en Internet	FrontPage, HoTMetaL
☐	Enseñanza en Internet	TopClass, First Class
☐	Manejo de correo electrónico	Pegasus, Eudora
☐	Internet browsers	Netscape Communicator, InternetExplorer, AOL
☐	Otros (especifique):	

2. ¿Tiene usted interés en aprender más sobre el uso de la computadora?

☐ No tengo ningún interés

☐ Tengo poco interés

☐ Tengo mucho interés

3. ¿Cuándo fue la última vez que usted asistió a un curso, seminario o taller de entrenamiento para uso de computadoras?

☐ Actualmente estoy participando en curso(s) para el uso de computadoras.

☐ Dentro de los últimos 6 meses.

☐ Dentro de los últimos 7-12 meses.

☐ Dentro de los últimos 12-24 meses.

☐ Hace más de dos años.

☐ Nunca.

4. Para saber usar los programas / software que usted usa actualmente, en su mayoría ¿cree usted que necesitó instrucción formal?

☐ No

☐ Si

2

5. ¿Le gustaría aprender a usar o mejorar su habilidad en el manejo de algunos programas de cómputo?

☐ No

☐ Si

¿Cuáles?

Fin de sección 1

Sección 2 acceso a computadoras y comunicaciones electrónicas

1. ¿Tiene usted acceso a una computadora en casa?

☐ No

☐ Si

2. Si respondió "Si" a la pregunta anterior...
El número de personas que usan una computadora en casa es:

☐ 1-2 personas / 1 computadora

☐ 3 ó más personas / 1 computadora

3. En su área de trabajo ¿tiene acceso al uso de computadora?

☐ No tengo.

☐ Insuficiente

☐ Más o menos suficiente

☐ Más que suficiente

4. ¿Con cuántas personas tiene que compartir la computadora?

☐ Usted solamente.

☐ Usted y otra persona.

☐ Usted y otras personas (2-4).

☐ Usted y más de cuatro personas.

☐ Usted NO tiene acceso a una computadora en el área de trabajo.

☐ Usted la utiliza en el Centro de Cómputo.

3

5. Por favor marque con una "✗" el planteamiento(s) que describa mejor cómo se siente usted acerca de su acceso a computadoras en el trabajo (marque todos los que sean pertinentes).

- ☐ En mi trabajo yo SI tengo acceso a una computadora pero no la uso.
- ☐ Yo no necesito una computadora para hacer mi trabajo.
- ☐ En mi trabajo yo tengo todo el acceso que necesito a una computadora.
- ☐ En mi trabajo, me gustaría tener (más) acceso a una computadora.

6. ¿Tiene usted cuenta de Internet (dirección electrónica)? (ya sea en el trabajo o a nivel personal)

- ☐ No
- ☐ Si

7. Durante las últimas cuatro semanas ¿qué tanto usó su cuenta de Internet?

- ☐ Nunca la usé.
- ☐ La usé una vez.
- ☐ La usé una vez a la semana.
- ☐ La usé al menos tres (3) veces cada semana.
- ☐ La usé prácticamente todos los días.
- ☐ No aplica.

8. ¿Se relaciona usted con personas con quien puede discutir problemas y/o soluciones acerca de computadoras?

- ☐ No
- ☐ Si

9. En el trabajo, usted desearía tener más acceso a:
(marque todas las opciones que sean pertinentes.)

- ☐ Computadoras
- ☐ w. w. w.
- ☐ Más programas de software
- ☐ Apoyo técnico/computación
- ☐ Correo electrónico
- ☐ Manuales
- ☐ Otro (especifique):

10. Comentarios opcionales: *Por favor siéntase en libertad de escribir sus comentarios respecto al acceso y disponibilidad de computadoras y comunicaciones electrónicas en el trabajo.*

Fin de sección 2

4

Sección 3 uso de computadoras y comunicaciones electrónicas para la enseñanza en la universidad

Por favor marque con una "✖" el número (sólo uno) que mejor describa su situación:

Durante el semestre pasado ... **Frecuencia:**	No impartí clases	Nunca	Una vez	Poco frecuente	Frecuente	Muy frecuente
1. En la impartición de sus clases, ¿usó computadoras en los periodos de clase?	0	1	2	3	4	5
2. Para preparar sus clases ¿utilizó equipo de cómputo?	0	1	2	3	4	5
3. ¿Le pidió a sus alumnos que usaran computadoras para realizar sus trabajos escolares?	0	1	2	3	4	5
4. ¿Usó correo electrónico para entregar materiales de clase a sus alumnos?	0	1	2	3	4	5
5. ¿Qué tan seguido usó el fax para comunicarse con sus estudiantes?	0	1	2	3	4	5
6. ¿Qué tan seguido usó correo electrónico para comunicarse con sus estudiantes?	0	1	2	3	4	5
7. ¿Qué tan seguido usó el teléfono para comunicarse con sus estudiantes?	0	1	2	3	4	5
8. ¿Qué tan seguido usó memorandums escritos a mano o a máquina para comunicarse con sus estudiantes?	0	1	2	3	4	5

9. ¿Está usted planeando reestructurar sus cursos para usar la computadora más que antes?
   - ☐ No
   - ☐ Si

10. Comentarios opcionales: Por favor siéntase en libertad de escribir sus comentarios respecto al uso de computadoras y comunicaciones electrónicas para la enseñanza en la universidad.

Fin de sección 3

5

Sección 4 conocimiento y seguridad para usar la computadora y comunicaciones electrónicas

En esta sección usted encontrará una serie de planteamientos referentes al uso de computadoras. Por favor marque con una "X" el número (sólo uno) que mejor describa su nivel de seguridad (conocimiento y certeza para ejecutar la operación que se describe.)

Mi nivel de seguridad para ejecutar esta operación es:				
No seguro/a 1	Poco seguro/a 2	Un tanto seguro/a 3	Seguro/a 4	Totalmente seguro/a 5

Planteamiento: Cuando necesito ...	Mi nivel de seguridad para ejecutar esta operación es:				
1. Resolver problemas en una computadora.	1	2	3	4	5
2. Instalar un paquete de software.	1	2	3	4	5
3. Entender terminología de hardware en computadoras.	1	2	3	4	5
4. Entender terminología de software en computadoras.	1	2	3	4	5
5. Enviar correo electrónico (aún usando software amigable).	1	2	3	4	5
6. Re-transmitir un mensaje en correo electrónico (forward).	1	2	3	4	5
7. Editar texto antes de re-transmitir un mensaje electrónico.	1	2	3	4	5
8. Anexar archivos junto con un mensaje electrónico.	1	2	3	4	5
9. Crear una lista de direcciones electrónicas.	1	2	3	4	5
10. Usar un list-server y chat rooms (conversación de grupo en vivo).	1	2	3	4	5
11. Buscar información específica en Internet.	1	2	3	4	5
12. Usar mecanismos de búsqueda (search engines) como Yahoo e.g.	1	2	3	4	5
13. Entender cómo funciona Internet.	1	2	3	4	5
14. Explicar cómo se almacena la información para Internet.	1	2	3	4	5
15. Crear una página en Internet (home page).	1	2	3	4	5
16. Obtener archivos (downloading) vía Internet.	1	2	3	4	5
17. Explicar cómo se transmite la información en Internet.	1	2	3	4	5

Fin de sección 4

6

Sección 5 posición con respecto a la tecnología para la enseñanza y su deseo de continuar estudiando

1. ¿Tiene usted interés en continuar su educación profesional ?

   ❑ No tengo ningún interés ❑ Tengo poco interés ❑ Tengo mucho interés

2. En el siguiente planteamiento se presentan algunas razones por las que usted continuaría su educación. Por favor, para cada razón, *marque con una "X" el número (sólo uno) que mejor describa el nivel de importancia que tenga para usted esa razón.*

Si yo tengo (tuviese) interés en continuar mi educación personal, es porque quiero ...	No Importante	Poco Importante	Importante	Muy Importante	Extremadamente importante
Mantenerme al día en mi tema	1	2	3	4	5
Obtener una satisfacción personal	1	2	3	4	5
Obtener créditos para un título de maestría o doctorado	1	2	3	4	5
Ser mejor en la enseñanza	1	2	3	4	5
Aprender más sobre mi tema	1	2	3	4	5
Alcanzar un mejor salario	1	2	3	4	5
Otra (especifique):	1	2	3	4	5

3. ¿Cree usted que necesita obtener otro grado académico?

   ❑ No

   ❑ Si

4. Si usted contestó "Si" a la pregunta anterior ...
   ¿Cuál es el área(s) de interés en la que usted quisiera obtener otro grado académico?

5. ¿Cuál cree que sea(n) el (los) mayor(es) obstáculo(s) para continuar su educación personal?

7

6. ¿Considera la modalidad *educación a distancia* como una opción para su educación propia?

❑ No ❑ Si ❑ No sé lo que esto implica

¿Porqué?

7. En su experiencia personal como estudiante, alguna vez ha recibido clases mediante el uso de medios alternativos de enseñanza, tales como: ... (marque todos los medios en que usted ha tenido experiencia)

❑ Televisión ❑ Software ó CD Rom

❑ Cursos de radio ❑ Internet

❑ Videocasetes ❑ Otro: _____

8. Si usted marcó alguno de los medios alternativos de enseñanza señalados arriba, de acuerdo a su experiencia, usted siente que ...

❑ Nunca vuelvo a considerar estos medios como una opción para la enseñanza-aprendizaje.

❑ Tal vez consideraría otra vez el uso de estos medios como una opción para la enseñanza- aprendizaje.

❑ Definitivamente SI volvería a considerar el uso de estos medios como una opción para la enseñanza-aprendizaje.

9. Digamos que usted tiene interés en aprender acerca de un tema específico, y la única opcion fuera disponible vía educación a distancia ... ¿Estaría usted en disposición de tomar el curso a distancia?

❑ No

❑ Si

❑ Tal vez

10. Si su respuesta anterior es "SI", estaría usted dispuesto a tomar el curso vía ..... (marque todas las respuestas que sean pertinentes.)

❑ Correspondencia (recibiendo materiales impresos que no incluyen medios electrónicos)

❑ Internet (uso de computadoras para comunicación que incluye sonido, video y mediata o inmediata interacción.)

❑ Satélite (transmisión en vivo de imágenes y sonido en un monitor de televisión; esto puede incluir participación en vivo por teléfono.)

❑ Video (video combinado con materiales impresos.)

8

11. ¿Cree usted tener interés en impartir cursos a distancia?

❑ No ❑ Si ❑ No sé lo que esto implica.

12. Comentarios opcionales: Por favor siéntase en libertad de compartir sus comentarios acerca de su posición con respecto a la tecnología para la enseñanza y la disponibilidad de oportunidades de educación.

Fin de sección 5

Sección 6 información descriptiva acerca de usted

1. Sexo: ❑ Femenino ❑ Masculino
2. Edad: _____años
3. Grado de estudios: ❑ Licenciatura ❑ Maestría ❑ Doctorado ❑ Otro:
4. Su habilidad en el idioma inglés es en:
   a) Lectura ❑____% Escribir ❑ _____%
   Escuchar/entender ❑____% Hablar ❑ _____ %
   b) ¿Ha hecho alguna vez el examen TOEFL? ❑ No ❑ Si
   c) Puntaje obtenido en el TOEFL: _____
5. Licenciatura: _____
6. Carga horaria: ❑ Asignatura. ❑ Medio tiempo ❑ Tiempo completo
7. ¿Cuántos años tiene de experiencia en la enseñanza en el CUCBA: _____ Años
8. El área de su disciplina se describe mejor como:
   ❑ Ciencias Agronómicas. ❑ Ciencias Médico Veterinarias.
   ❑ Ciencias Biológicas. ❑ Ciencias Sociales.
   ❑ Ciencias Exactas y Matemáticas. ❑ Otra:

Fin del cuestionario

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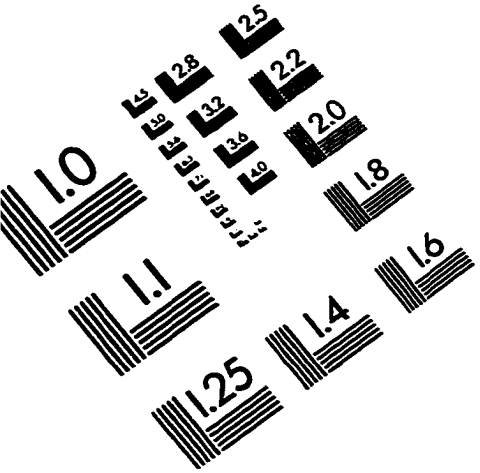
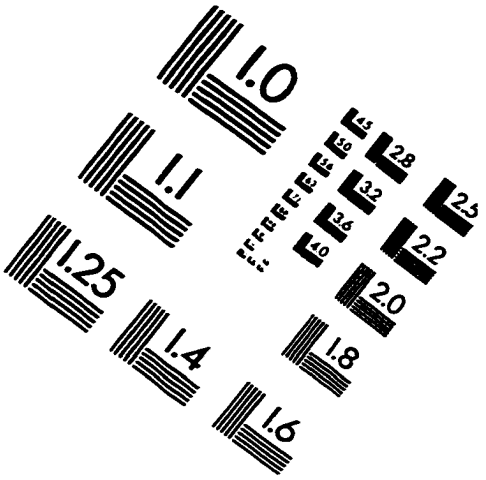
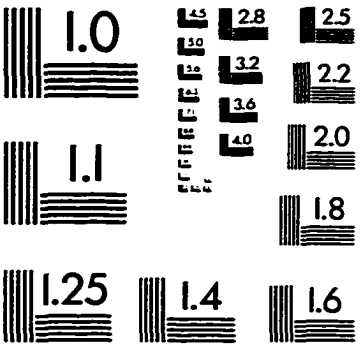
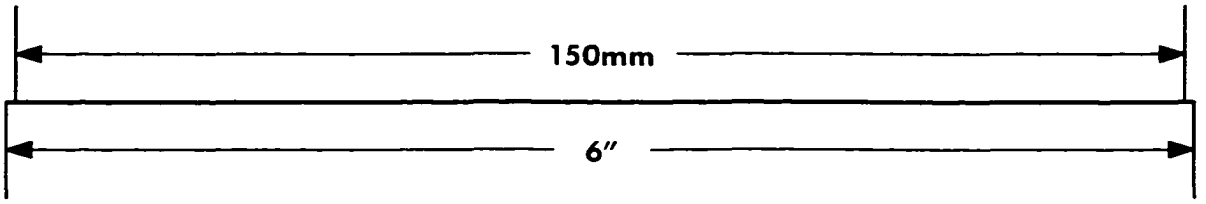
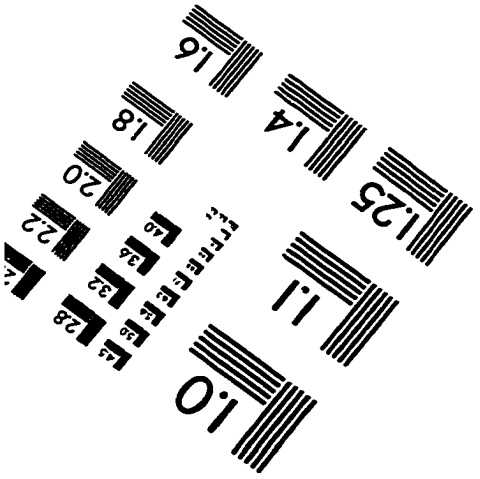
IMAGE EVALUATION
TEST TARGET (QA-3)

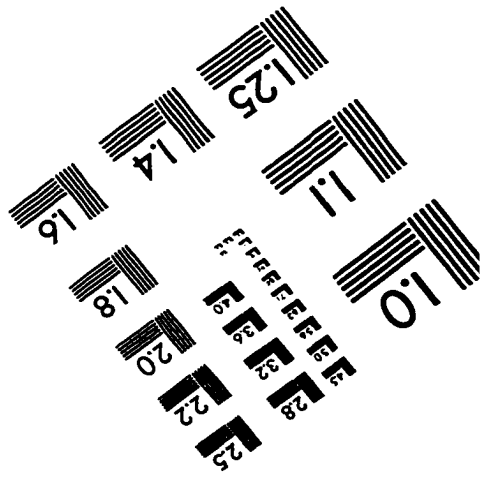












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